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CEREBRAL-MENTAL RELATIONS[1]

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For this address I have selected one of the oldest topics which has attracted the attention and thought of psychologists, but which through the centuries has ever remained of import to them, and has appeared worthy of discussion, viz., the relations of mind and brain. To this topic, in the special ways in which it may be considered, psychologists, philosophers, and others have devoted both time and space. By some it has been looked upon as a special part of the more general ontological speculation, and in relation to their epistemological musings it has been considered by others to be the more general problem. Whether or not there exist, in a philosophical sense, one or both of the things commonly called mental and material need not concern us in our scientific work; nor, except for our interest in the gymnastics of the thing we speak of as mind, need we consider the so-called causal relations of mind and body. I can conceive that the adoption of the relativity fashion may change our point of view. Psychological clothes may have to be cut more décolleté to compensate for the shortening of the skirts. Until, however the fashion is generally adopted, we may be satisfied with a more conservative, a more modest and unpretentious mode.

We may adopt as a working creed, but without a stable philosophical bias, the view that there is a mental, and that there is a physical. Until they are definitely shown to be

[1] Address of the president, before the American Psychological Association, Chicago Meeting, December, 1920.

one and not two, we may also believe for our practical purposes that these two are related somehow and in some way, and that the part of the so-called physical with which we may be chiefly concerned is that part called the nervous system. We should also recognize various orders of facts: (1) many facts regarding the nervous system may be discussed without reference to those terms that connote mental processes; (2) many facts regarding the mind are associated together without any knowledge of probable or possible cerebral intervention; (3) some mental states are known to occur when there are changes in the brain or in the nervous system; (4) when there are defects of the brain concomitant variations from the usual or the normal mental states are frequently observed; (5) mental differences exist without known structural or functional nervous alterations; and (6) certain brain variations are not accompanied by known mental variations. We are justified in dealing separately with the neurological facts and with the mental facts, and when concomitant variations are found we are also justified in trying to see stereoscopically the two sets of facts at one time, even though we may be unwilling to believe our eyes that the resultant picture represents reality, and even though we may be unwilling to ascend or to descend into the realms of philosophy to discuss causal relations or primacy. It is in this simple, naïve, artless (maybe ingenuous) way that my paper deals with the cerebral-mental relations. It is to the mental alterations accompanying cerebral lesions, and to the subsequent return to a normal or almost normal mental state without a corresponding recovery of normal brain condition, that I desire especially to direct your attention.

Before proceeding to the recounting of some of the facts which should be better known than they appear to be, it is well to report in a few words some of the conclusions of our scientific predecessors regarding these matters. The views of interest to us at this time do not antedate the work of Gall. Regardless of what we may conclude with respect to Gall's deductions and teachings, there can be little question that he was the great catalyzer who brought about or recreated

an interest in the scientific study of cerebral functions in relation to the mental. Two erroneous assumptions were made which vitiated the conclusions of the phrenologists: the first, psychological, that the mind is a complex of relatively independent faculties; the second, physiological, that the brain form corresponds with the outside skull form. Gall was more conservative than most of his followers, but his observations, incomplete but spectacular, led to the belief and to the teaching that the bony configurations of the skull are directly correlated with the mental faculties. Numerous observers, making numerous observations, failed to find these correlations, and Gall's conclusions were not confirmed.

This failure to find a satisfactory correlation soon led to the acceptance of the converse view. This is represented notably by Flourens, who held that the brain functions as a whole, all parts in every mental state, and that there is no mental function to be referred to any one cerebral part.

Many subsequent accurate observations of the brain in cases of injury or disease, especially by the French clinical neurologists, resulted in a reaction against this "all or none" view, and the culmination of this series came in the announcement by Broca of the discovery of the cerebral center for motor speech. When to this important cerebral-mental observation there were added the results of the later stimulation and extirpation results on animals, and the clinico-pathological observations of many observers, there was a return to a belief in the possibility of cerebral localization of mental functions, but not to the crude form that is evidenced in the writings of Gall and his followers. A later development of this scientific movement in seeking for definite localization of faculties, or mental processes, which had vogue and many followers a few years ago, is that of the histological localization of function. To the extreme form in which their conclusions have been presented I had occasion to offer a criticism some years ago. According to some of the histologists there are, for example, certain sensory cerebral centers and certain other perceptual or psychic centers. This conclusion is based on relatively crude histological and chemical

observations and naïve assumptions. Because, for example, two or more cerebral parts show some anatomical or chemical similarity they have been assumed to have similar or like functions. To put the matter crudely, although not in the words of the histologists, we should believe that because the brains of John Smith and Peter Jones look alike, because they have the same staining qualities, and because they have the same arrangement of cells and fibers, the two individuals should have had the same likes and dislikes, the same sensations and the same actions. This is well expressed by Lugaro who says, "The structure of the brain statically symbolizes . . . all that may occur in consciousness."

It is not my desire to utilize the time to criticize the past or to point out the incompletenesses of observations, the logical errors and the philosophical bias of our predecessors. I prefer rather to detail the present, to bring before you some recent observations, and to hope briefly of the future.

Let us start with some consideration of aphasia, since this particular series of defects has led many observers to travel the road of a modified phrenology. It will be remembered that the usual explanation for motor aphasia, whether it be articulatory or graphic, is that the inability is due to loss of kinesthetic images. In other words, it has been believed that the destruction of certain cerebral cells, or the breaking of the cellular connections, has robbed the individual of images which he had. If this explanation corresponded in general with the actuality, there would remain a more perplexing problem in connection with the processes and results of reëducation. Assuming for the moment that there are those cases in which the motor aphasia is not due to an anesthesia or to a sensory aphasia, how can the kinesthetic images be reproduced? Will it be necessary for the individual to go through a random series of movements, selecting those that please him, and finally after many trials and many errors, getting the correct motor response? Does the individual have the kinesthetic idea produced or re-created when the correct response is first given, or is the kinesthetic image or idea present only when the patient is able to make the necessary motor adjustments and reactions invariably?

In the memoirs of an aphasic physician, which have recently been reported for us,[1] there is an interesting series of observations which I recommend to you. Dr. Saloz, the patient, had a 'stroke', which did not produce unconsciousness, and there was no paralysis, but he was totally unable to speak, and had verbal deafness and agraphia. He lived six years after the cerebral injury, and he died from another disease. His brain showed 'considerable atrophy of the whole left hemisphere, and the results of a vast, exclusively sub-cortical destruction, extending over the whole zone of language.' During the six years between the 'stroke' and his death, he recovered the ability to speak, to write, and to understand. When he was able to write well, he began an autobiography of his life during the period following his stroke and his recovery of speech ability. Parts of this account are, or should be, of great interest to psychologists, especially to the introspectionists. An important point for us at the present moment is the account of his condition immediately following the 'stroke.' Of this he says: "At the moment I had no lack of continuity of consciousness (présence d'esprit) or in my thinking, and although things appeared much changed, I knew exactly what I wanted to say; I took account of the fact that my intact sensations had only lost their psychological instruments of expression through the symbols of language."

In other places Dr. Saloz seems to incline to the belief that what is lost in motor aphasia is a group or series of ideas or memories, when for example he says that logoplegia, whether motor or transmission aphasia, is a deficit of the articulatory and motor memory. On the other hand it should be said that the technical terms used by the biographer are not always, or regularly, used in the same way that the psychologist uses the terms, and the deficit of memory to which he refers the disorder is explained in his conclusions as a 'general faculty of abstraction, above all from the point of view of the conception of the will, as prime mover to all activity.' He recounts that at times, especially in the morning, he found a 'mixture of dysarthria, with letter and syllabic

[1] F. Naville, 'Mémoires d'un médecin aphasique,' *Arch. de Psychol.*, 1918, **17**, 1–57.

paraphasia,' due to 'a momentary forgetfulness of their sound and their place,' which brought about a 'deficient exteriorization.' In other words, the memory which is defective is a kind of sensory memory, upon which depends the understanding of heard and seen words, objects and the like.

Practically every patient with so-called complete motor aphasia retains the ability to say a few words. These are not always used correctly. Those most frequently retained are 'Yes,' 'No,' the patient's name, and very commonly a few simple oaths. Some of the verbal reactions that are given as apparently satisfying the patient's need of expression are amusing as well as pathetic. Such a case is that of a man whose expression was limited to "brown paper; no, green paper; no, biffin." This was his retained means of communication, at times unsatisfying to him but at other times completely satisfying his needs as he apparently felt them. This I say because of the evidence from his other overt behavior. Another individual was apparently satisfied by an 'ou-i, ou-i,' reaction at times, although he sometimes reacted as if disgusted with his inability to express himself, and as if his reaction came without volition on his part. Similarly a third patient said his name and his home address under all circumstances in attempting to communicate verbally. He would point to a paragraph in a letter from his sister, in which she asked about his condition, whether or not he needed money or clothes, and the like, or he would point to an object or to a printed word, giving voice to his name and his address. With this expression he was sometimes apparently quite satisfied, judging from his other reactions, and he would repeat these words over and over in different intonations as if he were saying a long sentence in which the words were more or less connected and emphasized.

I might also cite here other instances in motor aphasics with whom I have come in close contact to show the incongruities between the stimulus and the speech reaction, which incongruities were often not apparently appreciated by the patient. It is well recognized that the phenomena of para-

phasia are frequently due to this lack of appreciation of appropriateness. What are we to say about such patients? It is simple enough to adopt the dictum of Marie that we are dealing with 'a marked diminution of intellectual capacity,' which might conceivably cause these patients to be satisfied with their performances. But, do the reactions themselves give us any indication of the presence of kinesthetic images prior to or at the time the reactions are produced? No more, I would say, than do the ordinary reactions of dressing, or even those of rolling a piece of food about in the mouth in mastication. A stimulus produces a reaction, it may be of the hand in tying one's tie, or it may be of parts of the mouth in mastication, or it may be a more complex reaction of the combined organs in vocalization. Our ordinary speech reactions are almost exactly the same as many of our other daily activities, they are learned reactions or habits. Many of them are so-called motor habits and others are so-called sensory habits. In this connection I would have you direct your attention to the phenomenon of automatic writing. This is carried on unconsciously or sub-consciously, if you wish to accept such terms. I prefer to look at the phenomenon as simply a special habitual kind of reaction, a reaction produced when the appropriate stimulus, complex if you will, has been presented. There is no evidence to warrant the belief that images of any kind are involved in this process, and the image-loss explanation for motor aphasia is just as gratuitous as would be the explanation that kinesthetic images are involved in automatic writing.

Years ago Hughlings Jackson showed us that in some aphasics the so-called images remain unchanged, but in the search for spatial localizations of mental processes in the cerebral cortex, his teachings have been disregarded, or forgotten, or repressed. The reactions of the motor aphasic in the process of reëducation are precisely those of an animal in the acquisition of a new habit. At first the stimulus, whether it be auditory or visual, a word or another object, leads to the easiest or the most natural response. If the patient has retained 'yes' and 'no' these words are constantly

used. When other sounds are made, at first they are inapt, but after a time reactions become nearly appropriate and finally in the process of recovery they become definite, constant, precise, and adaptive. After a 'word' has been 'learned' and a new stimulus is given to the patient, he will go through a series of trial and error reactions, exhibiting his 'yes' and 'no' with his newly acquired word reaction, as well as a number of random speech movements as reactions to the new stimulus. He acts like the cat which, after having learned to open the door of the cage by pulling a string, is placed in another cage in which the string-pulling reaction must be replaced by a button-turning reaction.

In contrast to the foregoing, which has repeatedly been observed by me especially in the early periods of reëducation training, other significant observations were made in the teaching of motor and sensory aphasics. I showed to a patient pictures of objects and tried to get him to reacquire the appropriate vocalization reactions to them. After the patient had acquired the ability to react to a series of pictures in a suitable and regular manner I tried him on different pictures of similar objects. I then found that the particular reaction related to a particular stimulus was also obtained when other different, similar, appropriate stimuli were presented. For example, he formed the habit of saying 'hat' to the picture of a certain hat, but after this habit reaction had been acquired, the correct 'hat' reaction was obtained no matter what kind of a hat-picture was shown to him, and he did not voice the word 'hat' as the reaction to pictures of shoes or other wearing apparel, or of other objects.

In his suggestive study of similar cases of aphasia due to gunshot wounds of the cerebrum, Head[1] has also recorded numerous interesting facts which must be brought into some newer cerebral-mental relation than has been commonly taught. He asserts that "there is not a single manifestation presented by the defects of language, due to a unilateral lesion of the brain, that can be explained by destruction of auditory or visual images." His tests differed in many

[1] H. Head, 'Aphasia and Kindred Disorders of Speech,' *Brain*, 1920, **43**, 87–165.

respects from those that are commonly used in the determination of a diagnosis and in the clinical localization of the cerebral destruction. They were simple and complex, and they were continued through the early stages of the defect into the period when the patients showed a considerable amount of recovery of both sensory and motor speech ability. In the examination of an aphasic to determine his ability to take in a situation as a whole he asked the man to draw a plan of a room with which he was familiar. The patient, "who was an excellent draftsman before the injury, started well, but forgot the windows and the doors; moreover, he placed his seat alongside the fireplace, whereas it was in the middle of the room. He forgot the table in front of him, but filled in several details . . . of little comparative importance." In other words, the patient could draw, but he did not get the relations of parts of his drawing. Disorders of this character and others which have been noted more frequently are, according to Head, 'produced by dissociation of a definite mental process,' which he has called a dissociation of "symbolic thinking and expression. They are not due to a loss of motor or sensory power, to destruction of images or to a diminution of general intellectual capacity, but are caused by the breaking up of one aspect of psychical activity analagous, on a higher level, to the sensory dissociations which may follow a lesion of the post-central cortex."

The cases that we have just considered, those in which language in its broadest sense has temporarily been abolished or interfered with on account of cerebral injury, and in which recovery has taken place, make interesting commentary upon the current views of the relations of mental processes to the brain. The facts demand less of the theorist's consideration and more positivistic, scientific investigation. As corollary to them, but without further discussion at this time, I would also direct your attention to the fact that there are also those cases in which cerebral destructions in the 'zone of language' have not been accompanied by corresponding clinical manifestations of speech disturbance. A number of

such cases have been collected by von Monakow.[1] Some show destruction (cortical or subcortical) of Broca's area, others of Wernicke's 'sensory speech' area.

The phenomena accompanying destructions of the sensory and the motor systems of the cerebrum also have interest for us. We are aware that an individual may have a cortical lesion in the visual area, be blind to all new incoming stimuli, but retain the ability to see with the mind's eye. What is called the visual image may remain, even though there be a destruction of the parts of the cerebrum that are known in general to be concerned with the primary visual processes of sensation and perception. Monkeys which become blind after the destruction of the visual areas of the cerebrum may recover to such an extent that many of their ordinary visual-motor (I do not refer to the oculo-motor) reactions are carried out in an apparently normal manner. In the field of audition somewhat similar cases could be cited.

Lack of time prohibits a full consideration of many of the facts that can be cited in regard to sensory losses and sensory recoveries after cerebral lesions. With respect to the skin sensations following destructions of parts of the brain it is worth while to add a few words to what has already been reported regarding vision and hearing. Two collections of cells in the brain are known to be concerned with the sensations from the skin and the underlying tissues. These are the thalamus and the post-central cerebral cortex.[2] The thalamus is an afferent relay station for the impulses on the way to the cerebral cortex. It is an afferent station for the 'gross' forms of sensation, and through it there are brought about certain complex motor and visceral activities of the nature of reflexes. The cerebral cortex, on the other hand, is said to be concerned with the discrimination, including localization, of the sensations. A defect exclusively of this part of the cortex produces an inability to know more than

[1] C. v. Monakow, 'Die Localisation im Grosshirn und der Abbau der Funktion durch kortikale Herde,' 1914.

[2] Some contend that the sensory area we are considering overlies the precentral or motor, area.

the general fact that a stimulus, hot or cold or painful or tactile, has been received. Whether it be sharp or blunt, extended, narrow or thin, is not appreciated, and the fineness of localization is lost. The patient may know that some part of the leg or of the adjoining trunk has been stimulated, but he lacks the ability to locate the stimulus any more accurately. While this describes what I have also observed in lesions of the postcentral area, during the period after the cerebral insult and for some time thereafter, it is also apparent that some kind of adaptation or assumption of function does take place. Occasionally patients with an extensive destruction of this cortical area do not show the expected sensory alterations. I have in mind the case of a man whom I frequently examined, whose brain at autopsy showed almost complete destruction of the region we are considering. Because of the failure to find sensory disturbances I had not suspected that the lesion involved the cortex, especially the postcentral region, the remainder of the clinical picture being easily understood on the assumption of a combined, but relatively small, capsular and lenticular lesion. I first saw this patient several years after the cortical destruction, and we cannot be certain whether or not at any time he exhibited anesthesia or hypesthesia in the sense of being unable to discriminate and localize. Failure to discover the condition during the early days may have been due to a concomitant almost complete 'motor' aphasia, but in his last years in view of his speech reëducation this explanation cannot be seriously considered to be warranted. In some respects for my present purposes the case is not as clear-cut as could be wished.

A somewhat similar case to which objection of the same character cannot be offered has been reported for us by Brown and Stewart.[1] These authors had a patient with a gunshot wound of the left postcentral area which brought about an inability to localize stimuli on his right hand. Training in

[1] Brown, T. G., and Stewart, R. M., 'On Disturbances of the Localization and Discrimination of Sensations in Cases of Cerebral Lesions, and on the Possibility of Recovery of these Functions after a Process of Training,' *Brain*, 1916, **39**, 348–454.

localization was given, such as touching a part, and if the patient was not able to localize the stimulus, telling him where he had been stimulated. His attention was directed to the stimulus during the period of training, and he was advised to notice whatever he could that would enable him to make a localization by himself. One finger of the hand was selected for the training, in order that the localization ability of adjoining fingers that were not given 'training' could be compared with it. Any 'general' improvement of the hand as a whole could then be checked against a 'special' improvement due to the training. The results show a "marked improvement of the localization of tactile stimuli on the trained spots as compared with the accuracy of that localization on the same finger before the training, and with the accuracy of localization upon the other fingers after the training." The results in this case are, therefore, very similar to those in aphasics after reëducation. Some cerebral part other than the usual one has subsumed the function of the destroyed area.

Much could also be said of the relations of cerebral and especially cortical destructions in producing anomalous conditions of conation, will, volition, or whatever one cares to call that which goes on with voluntary activity. The destroyed brain parts are never regenerated, but many, perhaps all, patients who have had destructions of the precentral, or motor cortex, can reacquire the power of voluntary movement. In some cases this comes suddenly after a prolonged period of inability, in others it is a gradual development. So far as the crude introspective evidence goes the individuals have apparently not lost the things called kinesthetic images, they know what kind of a movement they desire to make and they have the other 'mental' predecessors of movement, but they fail in not being able to make the necessary muscles contract and relax. When in the process of sudden recovery the muscles are found to move voluntarily the result comes as a great surprise to them. This was the case with the soldier (with gunshot wound of the precentral area) who had unsuccessfully tried to move his fingers for more than six

months, but who, after a few manipulations and at my insistent demand, found that the motor impulse did break through.

In most cases the recovery is gradual, the first attempts at voluntary movements are sometimes futile, but when the first movements are obtained the result is a diffuse, and sometimes exaggerated, general activity of more than that part of the body which the patient tries to move. Occasionally both halves of the body are moved simultaneously. Only after long practice do these patients become able to control the movements to such an extent that a special reaction can be obtained invariably at command. And at times, even after this regained ability, certain movements, as movements, cannot be carried out, although the elements of the movements can be properly executed. Thus, a patient may be able to pronate and supinate, flex and extend all parts of his arm, but he may not be able to combine these simple reactions into a complex that will result, let us say, in the throwing of a ball.

Moreover, a phenomenon to which I have previously called attention in relation to aphasic conditions is not infrequently encountered. This is a fluctuation in ability ranging from apparent inability to exactitude and regularity of control, these two extremes being found on successive days or from hour to hour on the same day. Some motor aphasic patients can sing but they cannot talk, some paralytics are found asleep with their arms above their heads although in the waking state it is impossible for them to make an extensive movement of the shoulder. Conversely, under conditions of interest, such as that of competition, the resulting movement may be much more efficiently carried out than in the dull, routine training in the laboratory. This was apparent in the patient who had been hemiplegic about eighteen years when I began his motor reëducation. After he had progressed to a certain point he was graduated to a baseball squad in which he took part in a daily game of baseball on a small boy's size field. One day he made a hit, ran to first base, and then asked a spectator to bring him his cane

(which he had been accustomed to use during the eighteen years) 'because he could not walk without it'. Another patient who when sitting usually had to be helped to stand, was knocked down and in his resultant anger got upon his feet without help and thereafter was able to accomplish this act by himself.

An obvious criticism may be urged against accepting some of these facts as indicating recovery after cerebral destructions, because we have not had the opportunity of examining the brains. In the cases of gunshot wounds of the head such a criticism cannot be considered because knowledge is at hand of the cerebral destructions. Moreover one of the reëducated cases to which I have referred in a previous part of the paper has died and the examination of his brain revealed a complete destruction of the so-called motor cortex, with the lesion extending almost into the ventricle. In this case also, microscopical examination of the spinal cord shows what appears to be a complete degeneration of the crossed pyramidal tract.

A sufficient number of the elementary facts have now been placed before you to show (1) that although there is a general dependence of mental states upon the state of the brain, there is also (2) not the defined dependence of a special mental state upon the integrity of certain special cerebral parts. Whenever there is a disturbance of the cerebrum, there is an alteration of mentality. But even though the cerebral disturbance is a permanent damage or destruction, there is no certainty that the mental disturbance will be permanent. These are the points of the present paper.

My purpose in selecting this topic was not only to place before you some facts which are interesting in themselves, but also to call them to your attention as an indication of research possibilities in physiological psychology. A number of years ago Yerkes wrote that "such vague, general and probably inaccurate statements as those which are made in almost all textbooks which deal with this subject . . . are valuable only as emphasizing our crying need of facts in physiological psychology." The need is even greater today.

Clinicians have rather generally been satisfied with the collection of those facts that are important for diagnostic purposes. Psychologists have in general been satisfied to accept, mostly without doubt or due criticism, those neurological clinical facts that have been presented to them. Some neurologists have waked up to an appreciation of the necessity for finer examinations and for greater analyses along psychological lines, and it is to be hoped that psychologists will not hold themselves aloof from this field. Both can, and should, coöperate in the advancement of our knowledge along those lines which deal with the bodily mental relations.

THE MISUSE OF INSTINCT IN THE SOCIAL SCIENCES

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There is sufficient agreement at the present time as to the meaning of instinct to permit of a definition. Practically all English speaking psychologists reject the continental practice of considering it as any automatic action pattern, whether acquired or inherited, and limit it to those definite stimulus-response processes or action patterns which are inherited. This limitation to hereditary action-patterns is not, of course, identical with the term 'inborn' processes. The point of birth is nine months subsequent to the point of fertilization, at which the combination of hereditary characters takes place in the individual newly beginning life. During this intervening period many traits, which appear as automatisms at birth or for which the ground work is then laid, are acquired. An instinct is not only an inherited action pattern, but it is also definite. It is a specific response to a specific stimulus or set of stimuli.[1] One can not inherit an abstraction. Inheritance is either of concrete organs or tissues or of combinations of such, that is, of structures which determine the patterns of actions which inevitably proceed from them under unmodified conditions. These patterns of action, thus determined by the inherited organization of structures, we call instincts. Strictly speaking, one cannot inherit activities, but one may inherit the structure, the functioning of which determines the action pattern. This is our justification for speaking of the inheritance of instinct.

But action patterns can also be determined by acquired organization and functioning of structures. Practically all of the skills are such acquired or synthetic organizations of structure, functioning in different or more complex ways than

[1] Instinct as here used includes the reflex.

those to which inheritance directed them. Where such acquired or superinduced organizations of structures and functions occur and become automatic we speak of habit instead of instinct. Such modification of the organization of inherited structures, creating acquired action patterns or habits, occurs but slightly or seldom among the highly standardized basic structures of the human organism. In the bony structures it occurs directly scarcely at all, although the skillful surgeon may accomplish something here by way of modifications. Likewise in the visceral and glandular tissues and structures there is relatively little modification of functional organizations throughout life, although there are exceptions to this statement. The digestive system, for example, may adapt itself successively to different foods or even in extreme cases to narcotics and poisons with a high degree of success, and the glands are probably constantly undergoing minor and sometimes major changes in structure and function in disease or as a means to protecting the whole organism against a dangerous infection or a condition of strain. Other visceral functions and the structural organizations upon which they are based, such as breathing and the circulation of the blood and to a less degree the functions connected with sex, remain pretty constant throughout life. Consequently, we rightly regard these fundamental structural and functional organizations, which remain much or wholly the same throughout the life period and which are so basic to the life of the individual and the species, as mainly instinctive. They retain their inherited form with a minimum of change until the death of the individual.

But when we consider some of the more flexible and phylogenetically less basic structures and tissues of the body we find that they undergo a considerable modification of general structural and functional organization with the passage of time, and particularly in the first years of life, including the prenatal period of development. Even the minor and peripheral neuro-muscular controls—not those most basic to the evolution and survival of the type, such as those of the heart and those used in breathing—undergo a considerable

modification in their collective or functional structural organization. We are born with few skills in the neural structures which control these peripheral muscles, probably largely because of our long history of parental care through a prolonged period of infancy; but we acquire a vast multitude of such skills or functional organizations of structures under the pressures of modern civilization or the complex social environment which we call civilization. These acquired skills—although they may have instinctive foundations of a rudimentary and often imperceptible sort—are properly called habits. The historical process of evolution, out of which the instincts developed by means of natural selection, had no need of such skills, and they were consequently not selected into the organism by heredity. But our multiplied problems of organic adjustment to the physical environment, which is constantly differentiated into ever-increasing complexity through the medium of our expanding social environment, calls for a vast mass of neuro-muscular technique which may continue in operation for only a few generations or even decades but which must be spread abroad throughout the population almost simultaneously. Consequently these skills cannot by any manipulation of Mendelian inheritance be made to appear and become generalized throughout society through heredity. They must be acquired; they are habits.

An even more flexible part of the organism which lends itself to the formation of an infinite number of acquired functional organizations of structure is the brain. It would seem that the chief function of the flexible brain is to provide an organism, which has become fairly definitely set in its fundamental or basic vital and visceral structural organizations and can no longer modify them easily to fit new and ephemeral environmental conditions, with a mechanism for making multitudinous and rapid and, especially, most intimate and detailed adjustments to a highly complex and kaleidoscopic environment such as is created in and by the development of a social or rational world. For this reason the brain is the least set or permanently organized portion of the organism. Our neural stimulus-response processes or

action patterns are connected up after the point of fertilization, that is, after our heredity is organized or predetermined; and billions of these connections remain to be made even after birth. Even though we recognize the fact that vast numbers of these neural connections are made in carrying into effect the hereditary organization of the newly organized life cell at the point of fertilization, we must also recognize that, as soon as the environment begins to operate upon the growing organization of cells which constitute this new individual, the inherited adaptations begin to be modified and new connections are increasingly made to carry the environmental pressures or determiners into effect in action as the power and complexity of the environment increase for the individual. At the point where the environment has multiplied most largely its direct effects upon the individual, where he has established with it direct contacts through the media of language, custom, tradition, public opinion and the acquired muscular adaptations to his physical world, the influence of the hereditary determiners has become more and more indirect because their operation has been increasingly and repeatedly modified by interrupting environmental factors which build up substitute or modified neural response process connections in the cortex. Thus the brain, with its billions of neurons and the almost unlimited opportunity for acquired action-pattern or thought-pattern connections or combinations to be made within the cortex, becomes the chief region for habit formations. Here least of all—if at all—do we find developed the instinctive form of action.

The theory of innate or inherited ideas or images has been abandoned and relegated to the poetry of the mystics. Ideas and images are the product of acquired functional organizations of neural structures or habits. Likewise are our social and ethical ideals or values the result of such acquired organization. These last differ from ideas only in the complexity of the functional neural organization, permitting of a comparison and contrast of idea and imaginal units within the valuational complexes which we call social and ethical. To speak of instinctive ideas is manifestly absurd. To call ideals

or social and ethical values, negative or positive, such as goodness, criminality, democracy, or conservatism, instinctive or inherited is therefore manifestly unjustifiable. Such an employment of instinct can persist only among those who have not yet analyzed the processes by which action patterns are built up. The fundamental problem of the social sciences, which have grown out of the attempt to adjust man to his social environments, is therefore to work out the mechanism by which new and non-instinctive action and thought patterns are built up to mediate these adjustments of man to the social environments which the social sciences undertake.[1] The problem of the present article is not so ambitious as the one just stated and is confined to showing how and why the role of instinct has been overemphasized in the social sciences in recent years. Such a task is urgent in itself in order that those who are working in these subjects may not go farther afield in search of false but seductive leads.[2]

There are various forms of the misuse of instinct in the social sciences. One type, which is literary rather than pseudo-scientific and is found in particular among the poets and in belles lettres generally, but also among the technical writers, consists of such terms as 'instinct with perfume,'[3] 'instinct with life,'[4] 'instinct with heredity,'[5] 'instinct with the breath of heaven,'[6] and 'instinct with the spirit of hate.'[7] This use of the term has no hereditary significance whatever, but is merely a metaphorical way of saying that an object is filled with some prized quality. The most serious confusion, however, is the one mentioned in the preceding paragraphs,

[1] The writer expects to pursue this subject further in fulfilment of obligations for an Amherst Memorial Fellowship for research in social institutions granted him for the year 1921–1922.

[2] See especially the entertaining but inconclusive attempts in this direction in Taussig's 'Inventors and Money Makers,' and Carleton Parker's 'Motives in Economic Life' in the reports of the American Economic Association and the American Sociological Society for 1917.

[3] Maeterlinck, 'The Life of the Bee,' p. 304.

[4] Bryant, 'A Winter Piece.'

[5] Starch, 'Educational Psychology,' p. 24.

[6] Pares, 'Russia and Reform,' p. 92.

[7] *Nation*, 108: 313.

where the functioning automatism is not distinguished as to origin, any relatively fixed or definite action pattern being pronounced an instinct whether it is acquired or inherited. If all that the writer or reader meant to convey by such an employment of the term instinct (as seems to be the case with some continental and a few American writers in social science) is that the act is performed without reflection or consciousness of purpose or previous plan, little harm would in most cases be done. For example, if by saying that people are 'instinctively protectionists' [1] or by speaking of 'instinctive truth-telling' [2] the writers mean that certain people are protectionists or truth-tellers by habit, and if the reader understands such to be the sense of the expressions, it cannot be said that harm is done, although little may be gained in the way of closer definition of subject matter or technique from such indefinite employment of the term. However, the writer often confuses both himself and the reader by such vagueness of speaking, for he may at one time mean only to emphasize the automatic character of the act and at another he may fall back upon the recognized or approved meaning of the term, implying that the automatism is an inherited action pattern. Especially is there such danger of confusion to both reader and writer in the latter of the two expressions above and in such expressions as 'instinctive regard for law',[3] or 'the instinctive conservatism of the propertied,' [4] or this striking instance: 'Jefferson's instinct to keep the government close to the people.' [5] These are functional qualities, based upon highly complex organizations of acquired neural connections or structures and cannot be inherited, but must be acquired from experience. Yet it would be easy to cite several hundred similar instances of confusion in the employment of this term from a collection made by the author of

[1] Taussig, 'Principles of Economics,' I, 513; II, 267.
[2] Ellwood, 'Sociology in Its Psychological Aspects,' p. 223.
[3] Wilson, W., 'Division and Reunion,' p. 172.
[4] Ross, E. A., 'Principles of Sociology,' p. 506.
[5] Vrooman, F. B., 'The New Politics,' p. 243.

this article, many of them drawn from some of the leading writers of the day in the social sciences.[1]

This vague employment of the term instinct finds its logical reductio ad absurdum in the application of the term to well-developed habit complexes, such as the 'instincts' listed in the classification in McDougall's 'Introduction to Social Psychology' and the various books on educational psychology of recent years. The most cursory analysis of the origin of the action patterns involved in such so-called instincts as the parental instinct,[2] reproductive instinct,[3] fighting instinct,[4] instinct of self-preservation,[5] the gregarious instinct,[6] and the like will show that by far the majority of the action content is acquired. Most of what a parent does for a child is the product of racial or individual experience and therefore belongs to the category of acquired habit rather than to that of inheritance or instinct. The same is true of the content of the other so-called instincts mentioned in this paragraph. To characterize such habit complexes as instincts implies either the abandonment of the accepted and desirable

[1] For some years the writer has been collecting and tabulating examples of the use of instinct in various fields of thought, the collection now numbering several thousand examples.

[2] Ellwood, 'Sociology in Its Psychological Aspects,' 213, 241; Coe, G. A. 'Psychology of Religion,' 94; Hayes, E. C., 'Introduction to the Study of Sociology,' 214; Kidd, B., 'Social Evolution,' 315; Kirkpatrick, 'Fundamentals of Child Study,' 46, *passim* (22 times); McDougall, 'Social Psychology,' 66, *passim* (28 times); Pillsbury, 'Fundamentals of Psychology,' 425; Shand, 'Foundations of Character,' 38, *passim* (11 times); Wallas, 'The Great Society,' 39, *passim*; etc.

[3] Conklin, E. G., 'Heredity and Environment,' 322; Hayes, *op. cit.*, 46; Kirkpatrick, *op. cit.*, 46; McDougall, *op. cit.*, 266, *passim*; etc.

[4] Ellwood, *op. cit.*, 216, 217; Hall, G. S., 'Adolescence,' I: 358; Kidd, *op. cit.*, 42; Kirkpatrick, *op. cit.*, 40, *passim* (9 times); Ross, *op. cit.*, 44, 606, 677; Starch, *op. cit.*, 420; Taussig, 'Principles of Economics,' II, 334; Thorndike, 'Original Nature of Man,' 68, *passim*; Wallas, *op. cit.*, 43, *passim*; etc.

[5] Blackmar and Gillin, 'Outlines of Sociology,' 232; Conn, 'Social Heredity and Social Evolution,' 249; Bücher, 'Industrial Evolution,' 1, *passim*; Crile, G. W., 'Man—An Adaptive Mechanism,' 38, 45; Durant, W., 'Philosophy and the Social Problem,' 147, 378; Ellwood, *op. cit.*, 216; Kirkpatrick, *op. cit.*, 92, 107; Shand, *op. cit.*, 182; Trotter, 'Instincts of the Herd in Peace and War,' 12, *passim*; Veblen, 'Theory of the Leisure Class,' 42, 110; etc.; etc.

[6] Durant, *op. cit.*, 161; Ellwood, *op. cit.*, 221, 290; Hayes, *op. cit.*, 214; Kirkpatrick, *op. cit.*, 119, 125; McDougall, *op. cit.*, 84, *passim* (16 times); Ross, *op. cit.*, 45; Sumner, 'Folkways,' 212; Trotter, *op. cit.*, 41, *passim*; Wallas, *op. cit.*, 39, *passim*; etc.

definition of instinct as stated above or a failure to analyze the structure of the acts involved. An instinct, since it is as much a unit character as any other product of Mendelian inheritance, is inconceivable apart from the fact of its structure.

However, there are many, psychologists as well as social scientists and others, who do think of the term instinct in such a vague and indefinite manner. They look upon it as a mystical something, variously denominating it as a 'tendency' or 'urge' or 'motor impulse' or 'quality of the act,' etc. Their thinking is metaphysical and animistic rather than scientific. They have either come to the social and mental sciences by the way of the vague and resonant categories of metaphysics and *a priori* logic and have remained untouched by the biological foundations of these sciences which they profess, or they have failed to grasp the true significance of the Mendelian theory for the social and mental sciences as well as for biology. Those who would admit that the total set of acts included under the terms 'fighting' or 'self-preservation' as applied to activities in the modern world are predominantly acquired rather than inherited may still erroneously believe that such a set of acts is instinctive because it is the result of some undefined 'tendency' to act in that way. Or they may claim that the habit complexes 'fighting' or 'self-preservation,' have original instinctive 'cores.' Or they may believe with McDougall that the habit complex is developed around an emotion and its derivative sentiments and that the emotion is the central and unchanging element of the original instinct from which the act takes its name.[1] Or, finally, the writer may have no clearly defined notion of how he may justify calling a habit complex an instinct but he 'feels' that the habit complex is 'dominated by' instincts or 'grows out of instincts.'

This claim that the habit complex, often miscalled instinct, is dominated by instinct in its formation will be examined in a later paragraph. The other assertion, that the habit complex is built upon an instinctive foundation, is of course in some

[1] *Op. cit.*, 33, 46.

sense always true, for all acquired action patterns must grow up as the differential phase or superstructure of inherited capacities and activity bases. But such a relationship of derivation, often very indirect and distantly connected in its nature, by no means argues an identity; nor would it be worth while asserting this fact if it were not so often urged in good faith and with all seriousness. The argument for calling an acquired complex an instinct on the ground that there is a 'tendency' to act in that way reduces upon analysis to the same proposition. A 'tendency,' which is not a purely metaphysical and mystical adumbration, must clearly be a neural disposition or set of neural processes. Such a neural disposition, if inherited, can be no more than the instinctive basis of the habit complex, often quite minute and remote and therefore frequently unrecognizable, in the final complex acquired activity organization. Most of those who explain the leap from real instincts to pseudo-instincts or habit complexes on the basis of an imputed 'tendency' are merely mystics. The others have not yet analyzed their proposition to its logical consequences.

The argument of the 'core' is essentially of the same character, unless indeed it resolves itself into that of the central emotion or the argument of dominance of the habit complex under the influence of a powerful constituent instinct. An example of this last type of argument may be found in the justification of the employment of the term 'reproductive instinct' (really a complex of instincts and acquired habits) on the ground that the complex is formed under the dominance of the powerful 'sex instinct,' which by the way is—as ordinarily used—a complex of various sex instincts and habits in which the truly instinctive maturation and expulsion of the seminal fluid by the male and equally instinctive action of the uterus and ovaries in the female may possibly be regarded as central if not dominant in the complex process. But there is vastly more to reproduction than these acts and these acts may take place without resulting in reproduction. The so-called 'maternal instinct' may be taken as an example of the former assumption regarding the 'core.' Here, follow-

ing McDougall and others, the 'tender' emotion is central and dominant and is characteristic of the 'maternal instinct,' hence it builds up around itself all those acquired activities into a child-caring complex which are necessary to its satisfaction. This argument would seem to be equally mystical. This 'instinct,' with its unchanging central emotion, is purely an assumption and is not defined at all by McDougall in terms of its original structure (as all instincts must be defined) but rather in terms of its highly sophisticated functioning in every day civilized life. This amounts to defining a hypothecated instinct and accompanying emotion in terms of its modified expression in use under the pressures of a highly artificial environment, a procedure which is just the reverse of the accepted methods of inductive generalization. It is nothing less than mystical apriorism.

The assumption of an original and unchanging characteristic central emotion, which is the essential attribute of the instinct, is itself without foundation in the data. The fact is that every action pattern which fails to function with perfect automaticity develops some sort of emotion or other mental expression which is characteristic of the act performed or attempted. But a purely instinctive action pattern, functioning without interruption or hindrance, should develop no consciousness and therefore should be without a characteristic emotion such as McDougall insists upon. However, when the inherited action pattern or instinctive functional organization does not work smoothly because of the interrupting pressures of the environments—and in our modern complex civilized world, where the environment modifies and dominates practically every original tendency, it is probably impossible for any instinct to function with complete automaticity—consciousness, including emotion, enters into the process in proportion as the original activity process is interrupted or distorted by environmental pressures. Consequently, the less instinctive an act is the more emotion or other mental expression it is likely to develop. The complex habit dispositions should therefore have more emotional content than any constituent instinctive element, or, for that

matter, than any constituent well established acquired automatism. If the quantity of the emotion is determined by the degree of environmental interruption or the necessity of making an adjustment in process of expression, the quality of the emotion is equally determined by the functional content or direction of the emotion, that is, by the character of the acts performed. It is not necessary that these acts be instinctive in origin. In fact, the origin of the act, whether inherited or acquired, has nothing to do with the determination of the quality of the emotion. The structure and the quality of an action pattern, provided it mediates the same adjustment process, remain unchanged regardless of whether the action pattern is inherited or acquired. Habits and instincts do not necessarily differ in mechanism, except where they are organized in the service of different functions, nor do they differ in degree of automaticity, except where environmental pressures bear upon them with different degrees of intensity, which are causes of variation wholly apart from the nature of the action patterns themselves. They differ essentially only in their origins. The quality of the emotion, which is the sign of interrupted adjustment, is characterized by the function it is serving and not by the origin of the action pattern with which it is connected. These conclusions would lead us to deny McDougall's assumption that a habit complex is an instinct or the creation of an instinct because of a central characteristic emotion, and to affirm, following the James-Lange theory of emotion in its main outlines, that the emotion springs up essentially in the process of habitualization of an act and proceeds from the process instead of creating it. It is the result of the weakening of an instinct rather than of its dominance.

This line of argument leads us to deny some further implications of certain highly sophisticated types of definitions of instinct. For example, the claim of some authors[1] that instinct involves a conscious element is clearly untenable. Such writers have lost sight of instinct as it appears in its purest form in the lower animals. Among men the instincts

[1] McDougall, *op. cit.*, 29; Pillsbury, *op. cit.*, 421 ff.; and many others.

have become largely distorted by the lengthening period of infancy and by man's increasing susceptibility through his highly flexible cortical processes to environmental influences —most of which he has himself accumulated as social habits through a long period of social evolution—with the result that many of the instincts which function intact in the lower animals are merely vestigial in man or have become broken up and detached from their former places in the developmental process as a whole and reattached to some particular section or aspect of it. The result is that man has come to be primarily dependent upon his social environment for guidance in the building of his action patterns, and, since that environment changes constantly and rapidly, it is inevitable that there is a large element of consciousness in most human acts which are at all complex in character. The failure to recognize these facts, of the vestigial or delayed character of many human instincts and of the large element of consciousness necessarily involved in human conduct, is alone responsible for the inclusion of consciousness of stimulus and of end in the definition of instinct.

No more is it proper to speak of purposiveness as essentially characteristic of instinct. We customarily regard any activity which serves to adjust the organism to its environment as purposive. If consciousness of the end enters into the act the purposive character is even more evident. But the attribution of purpose is in no sense dependent upon the origin of the act. As with the emotional content, the sense of purpose is dependent alone upon the functional nature of the act. Consciousness of the end being characteristic of the most highly developed purposiveness in action, we may say on the basis of our previous argument that habit adjustment or acquired action patterns have a higher degree of purposiveness than have instinctive acts. Similarly erroneous is the claim[1] that instinct is to be defined in terms of the function of the act. The function of the act has no necessary relation to its origin. All acts have some functional significance in the scheme of things. Nor does the fact that an

[1] Pillsbury, 'Fundamentals of Psychology,' 422 ff.

act is pleasurable signify[1] that it is instinctive in origin. Investigations into the neural correlates of feeling show conclusively that feeling is the function of the organization of the act and not of its origin, except in the negative sense that instinctive acts would not normally be unpleasant under natural conditions. But under the artificial conditions of civilization they may easily give rise to unpleasantness, while acquired action processes are often the sources of the highest if not of the intensest pleasures.[2]

So much for the analysis of the current misconceptions of the nature of instinct. In this discussion it has been pertinent to refer to the psychologists almost as often as to the social scientists, which is fitting, because the latter have largely copied their understanding of instinct from the former. In fact, both groups fell into their error about instinct quite naturally as a result of the old biology which was dominant at the time most of the authorities on instinct received their 'set' in thinking on this matter. When they studied biology the theory of the inheritance of acquired characters had indeed received its death blow at the hands of Weismann and others, but the new views had not yet so thoroughly permeated the backgrounds of their thinking, and of thinking in general, upon inheritance that they were enabled to divest themselves of the old preconceptions about what sorts of things are inheritable. Even when the Mendelian theory did become generally known in 1900 and in the decade following, it did not at once dissipate antagonistic ways of thinking. In fact it has by no means done so even yet. It is one thing to master a theory and a very different matter to reorganize one's ideas and reclassify one's knowledge and preconceptions in keeping with it. Very few people ever do the latter with anything like adequacy, if they have already made a pretty thorough adjustment to a science before an epoch making theory appears in it. An illustration of this sort of discrepancy is afforded by the following definition of heredity:

[1] *Ibid.*, 431, 441.

[2] Cf. Meyer, 'The Neural Correlate of Feeling,' PSYCHOL. REV., 1908, 15, 307 ff.; Bernard, 'Transition to an Objective Standard of Social Control,' Chs. 2 and 3.

"By heredity is meant the degree of likeness between parents and offspring." [1] Although this definition was written by the professor of zoölogy in the University of Birmingham eleven years after the dissemination of the Mendelian theory, which must have been known to him, it would be difficult to select another definition so inadequate to Mendelian principles.

We are only beginning to square our psychology and our sociology, on their genetic sides, with Mendelian principles of heredity. The old theories of instinct are essentially Lamarckian and Galtonian, and even metaphysically vitalistic, in their accounts of derivation. The new theories of instinct, which recognize an instinct as a concretely definable unit character in the Mendelian sense, must be developed by students who come directly to the mental and social sciences with the Mendelian and Weismannian hypotheses and the newer biochemical and biophysical biology without the disturbing penumbra of the older views of heredity and metaphysical and vitalistic biology which have not been thoroughly extirpated from the thinking of the present generation of scientists.

Viewed in this light, activity complexes, such as were described above, can no longer be called instincts. Their acquired content becomes too obvious. The actual instincts are at once much simpler and more elemental and much more numerous than those set forth in the classifications of such writers as McDougall,[2] Thorndike,[3] and other psychologists. There are probably hundreds or even thousands (if we include the reflexes under the general heading of instinct) of these inherited mechanisms, mainly overlooked by the casual observer because they do not ordinarily function as independent units in adjustment processes but rather as constituent elements in larger habit complexes developed in response to environmental pressures.[4]

[1] Gamble, 'The Animal World,' 1911, p. 230.

[2] *Op. cit.*

[3] 'Original Nature of Man.'

[4] See Shand, 'The Foundations of Character,' for examples of how some of these supposed complex instincts may be broken up into simpler elements.

It is true that these habit complexes are built upon these elementary and relatively minute instinctive bases, but it does not necessarily follow that any particular habit complex is built directly upon any particular instinct or group of instincts. If we liken habit to a building which is reared upon a foundation constructed of stones to correspond to the instincts, we may compare various constituent habit complexes to the successive stories in a skyscraper. Some habit complexes are low down upon the bed rock of instinct, while others are near the top of the building and have only very indirect contacts with the basic instinctive tendencies. It is also well to recognize that in our modern civilization these skyscrapers of habit are sometimes built very tall. Some men live lives which are relatively close to instinct, while other men build story after story of culture and sublimated interests until instinct is scarcely discernible in them in its original forms. Each successive story of habit formation is built upon the next story below and not upon the native instincts at the base, although even the most cultivated man may, under the stress of great crises or fear or illness, descend into the basement of the structure of his character and for a time live on a level with his instincts, forgetting his better and acquired nature.

Modern civilization is like a city of such skyscrapers. Organized into blocks and sections of this city, facing along certain streets, which we may liken to the avenues of custom and tradition, of public opinion and convention, they collectively constitute the tremendous social environment divided functionally, if not geographically, into institutions. As each new individual comes into the world he has much the same foundation as others have of native soil upon which to build, varied to be sure here and there by excavations, marsh land, hill, or stone; but whether this individual grows into a towering skyscraper, a dingy tenement house (like some erudite but confused scholars!) or is arrested in his development as a shanty in the slums, depends not so much upon the character of the soil, as defined above, upon which the superstructure is reared, as upon the environment in which it

grows. Just as the character of the building on lower Broadway will inevitably differ from that of the Bronx or Flatbush or Hoboken, so will the human character vary according to and in response to the social environment, the native soil or instinct exercising a deciding influence only when its character is so markedly exceptional as to make the usual structure suited to that environment manifestly impossible.

While the above description is in the nature of an analogy rather than an analysis of the concrete activity processes connected with the development of character, I believe the description is essentially true to the facts. The instincts are very early overlaid by acquired habits in the process of adapting the individual to his environment, and these habits are in turn overlaid by other tiers or stories of habit in which the native character of instinct ever constantly diminishes in proportion and intensity, until the child who has reached a rationalizing age is reacting in nine tenths or ninety-nine one-hundredths of his character directly to environment, and only in the slight residual fraction of his nature directly to instinct. The influence of environment is cumulative in our lives and the decay of the influence of instinct is progressive.

Other evidence that instinct does not dominate habit formation is to be found in the fact that the extension of the period of infancy in man has distorted the growth process so far as the instincts are concerned and has substituted to a large degree the active care of the mother for the guidance of instincts in the child's development. As a result, some of the instincts which function completely in the lower animals, such as walking and running and the making of definite movements connected with food-getting, have been rendered largely vestigial by the substitution of the mother's providence. Other instincts, such as those of sex, have not been rendered vestigial but have been torn from their moorings in connection with the early stages of the growth process and have been attached to a particular stage of development farther along. These may be called delayed instincts. The former class of instincts tend to drop out of the developmental process altogether, or to be broken up into their con-

stituent reflexes which are now reorganized around other functional activity processes—mainly habit complexes,—or they are so modified by the developmental process, controlled by parents and community, that they never appear in their original form or in complete maturity.

The same modification of the original action pattern by environment happens, to a less degree, in the case of the delayed instincts. Already, before they appear, the organism has developed such a large complex of habit adjustments to the environment, which are so far in advance of the adjustments which the lower animal forms make to the environment, even after these instincts have appeared in the developmental process, that the now delayed instincts come into action in the higher life forms in combination with a different set of functioning activities from that which historically they are adapted to. Consequently they undergo modification, either in structure or in organization, from the inception of their development. Thus the sex instincts in man do not appear in an organism possessing simple and unsophisticated activities and without learned sex attitudes and moral preconceptions, as would be the case in much lower life forms, but they begin to function in a being who has already a set of habit controls, especially adapted to his civilized environment, called 'sex morals.' He has also learned a wide range of vocational and æsthetic activities which compete in the expenditure of energy and time with the sex impulses. Also, and a matter of the greatest importance, this sophisticated animal has learned to wear clothes, which fact serves in numerous ways to inhibit the stimuli to the instinctive activities of sex. In this way the sex life has been conditioned, almost set, before the sex instincts appear. As a consequence, most of man's sex life is learned and is hemmed about with modifications and transformed with sublimations and perversions. Because the basic inherited physiological processes of sex—the true sex instincts—are necessary to the perpetuation of the race they remain intact instead of becoming vestigial, as is the case with instincts for which the acts of another can be substituted in the developmental process.

But, none the less, their functioning—the extent of their exercise and the direction or application which they take (whether in adaptation to reproduction or to amusement or to more decided, even commercialized, perversions)—depends upon the controls—largely antedating their maturity—which have been developed in man's social environment. Even they, although intact in their elementary forms, do not control the environment of habit, except in a diminishing and minor degree, as civilization advances. The vestigial instincts control habit formation in even a less degree; are in fact being destroyed by the accumulated force of environment functioning in their stead, better to meet the contingencies of an ever more complex and more rapidly changing world.

This view that instinct in the human type is being disintegrated by the encroachment of habit, aided by the vestigial and delayed character of many or most of the instincts, consequent upon the extension of the growth period, may be objected to and the contrary argument advanced that man has more, rather than fewer, instincts than the lower animals. Such has often been asserted[1] and recently definitely denied.[2] It seems very unlikely that the human animal is in process of acquiring new instincts; certainly not such complex ones as the less critical psychologists attribute to him. There are a number of significant facts which contradict such an assumption. In the first place, the mathematical laws of chance are against it. An instinct as complex as the 'maternal' or 'gregarious' or 'rationalizing' instinct, involving as it would in the aggregate of some millions of neural connections or processes (for there must be at least so many neural dispositions for each of these class terms or 'instincts' as there are ways or combinations of ways in which each of the groups of functions represented by these terms may be carried on), would appear as a spontaneous mutation (never, of course, as inheritance of acquired traits) with just the proper organization to fit the requirements of the environment of that particular time and the place, in some

[1] Cf. William James, 'Psychology,' Ch. 24.
[2] Cf. Miller, 'The Psychology of Thinking,' 76–77.

highly fortunate individual, only once in an age. The statistician would not expect to see such an instinct crop up in large numbers of the population in a single generation. Take, for example, the rather wide spread abilities of the Italians to sing and to appreciate grand opera. Often these abilities are said to be inherited. They are extremely complex, consisting of a manifold technique of muscle, vocalization, symbolization, etc., in which perhaps tens of thousands of neural connections of a very definite order and organization are involved. It does not seem likely on the basis of the laws of chance that the highly complex ability or 'instinct' to sing grand opera would appear spontaneously in so many thousands of Italians since 1600, whereas it had never appeared at all even among this musical people before that time. It seems much more likely that, living in a musical environment and aided by the inheritance of organic structures of the inner ear which make pitch and tone discrimination easy for them, they have learned instead of inherited the highly complex content and technique of their art. If one can learn Greek or Sanscrit, although one has no Greek or Hindu blood in his veins, hence no conceivable heredity for these languages, might he not also learn grand opera, especially if the environment is favorable to this acquirement? Or, shall we suppose that only those who have a spontaneous mutation for Greek and Sanscrit and grand opera can learn these languages or execute this type of music? The proposition becomes absurd. Yet it is not unfair to the assumptions of those who speak of complex social instincts which consist of activity complexes unknown to earlier generations and which therefore must have been organized but recently. The so-called instincts of democracy (conceived as functioning in the modern socialized state), of fighting (when applied to modern scientific warfare), or of gregariousness (if meant to include the multifarious forms of modern intercourse) are examples in point. If we always remember that there can be no instinct apart from its structural and activity content, that it is never a mystical 'entity,' 'tendency,' 'influence' or other indefinite mask for ignorance, but always a concrete reality, in the last analysis

biological in its nature, there will be no occasion for supposing that such recently organized complex activities or highly fluid and changing classes of activities could appear as mutations in a great number of people in a short period of time, if at all.

But, for the sake of argument, let us suppose that a very few people might be blessed with a spontaneous mutation which gave them the power to execute grand opera, or any one of the complex 'instincts' such as the recent social and educational psychologists impute to us. How could these complex abilities be generalized to the whole population? Certainly it could not be done in a single generation, nor in ten thousand generations. The organization of society, with its taboos on race and class interbreeding, being such as it is, it is doubtful if such traits could ever be disseminated throughout the human race. Certainly for slow-breeding man the time element would be prohibitive for the rapid dissemination of new traits by means of heredity. And yet, most of the present-day content of the complex 'instincts,' such as fighting, mother-care, gregariousness, self-preservation, and the like, is not very old. Very little human fighting, for example, is any longer of the character engaged in by lower animals, but involves the most complex technique of manipulation of firearms, poison gas, field guns, map-making, field tactics and parliamentary wrangles, to say nothing of the journalistic sideshows. All of this, if instinctive—and nothing is instinctive about an 'instinct' if the concrete action content is not—must have been spread abroad throughout the world in a generation or two or three by biological inheritance! It would be remarkable, if true.

It will avail nothing to fall back upon a mystical interpretation of instinct, as a method of refuting these facts, claiming that it is the 'central emotion' or the 'tendency' which is inherited and that these come down from man's prehuman ancestors. This argument was exploded earlier in this article. An emotion is not a mystical entity, resting in some isolated corner of the brain, which dominates action much as the metaphysical or supernatural 'free will' was

formerly supposed to do. Emotion is correlated with and characterized by the whole act which comes into consciousness in any degree, whether it is an instinctive or a habitual act. The isolated and unchanging central emotion of McDougall is a myth. Instinct is action according to a structural action pattern or it is nothing. To repeat, we do not inherit abstractions, but concrete biological organs and structures. Neither is our inheritance lateral, across generations from contemporary to contemporary, but longitudinal and differential, from generation to generation. Consequently we may conclude that if new instincts, complex and peculiar to man, were appearing they would not so quickly spread to the human race as they seem to do. Only acquired action patterns can be disseminated in this way.

The demand of the accumulated complex social environment, which we call modern civilization, is for an organism with a maximum of variation of activity at a maximum of speed. Only with such capacity for change can man make the most of his powers and reap the largest reward from nature's resources and society's riches. Only with such powers can man be so ubiquitous, adapting himself to all climes in quick succession, living under all the conceivable conditions which his interests dictate. The insect has a narrow locus and dies in the same season in which it is born, or it makes the transition by means of metamorphosis. Its instincts are practically fixed. If man was solely a creature of instinct he too could not enjoy his vast range of adaptability. It is because his completer or progressive development demands ever greater flexibility of adptation that he is shedding his instincts as he evolves and substituting for them control through the growing and self-perfecting institutions of his social environment. Man is able to dispense with instinct because he has a highly complex and well organized social environment, and in so far as this environment is improved and becomes more adequately organized to meet his present and future needs it dispenses with his instincts in the evolutionary process of selection or it represses and transforms them in the progressive character development

of the individual. For man to be accumulating new instincts instead of losing or repressing and transforming old ones would work exactly contrary to his needs of adaptation to his increasingly complex and changing environment. The rate and mass and degree of change in this environment are already so great that his adaptations could not possibly be made on the basis of instinct alone or even primarily.

Are we not, then, in the light of these facts, forced to the conclusion that the complex social 'instincts' are in reality aggregates of habits, organized and reorganized from more elementary habits and simple constituent instincts, with reference to some specific function, the content constantly changing as the function and organization of the adjustment to be made vary? Although the content of the habit complex, miscalled instinct, varies constantly with the character of the adjustment, the aggregate of acts itself retains the same class name as long as it serves the same general function in society or for the individual. Thus, the habit complex tends to be named with reference to its function or according to its value—as maternal, gregarious, ethical, fighting—while the content varies infinitely, never consecutively possessing that unity of character which is essential to the concreteness of biological instinct. The class term for the group of fluid or changing acts is an abstraction representing ordinarily a social valuation, although it may also be named generically after the root type of structure to which it conforms. The explanation for calling the habit complex an instinct is sometimes the confusion of automaticity with inheritance and sometimes an inability to separate the total aggregate of activities from some prominent instinctive act which is included in it. Sometimes it is both. Both criteria are deceptive guides. Sometimes the resemblance between the total habit complex and the constituent or foundation instinct is more symbolical than real. Sometimes it represents the continuation of a name long after the habit complex, through growth in content and changed adaptation, has undergone a complete transformation of character and has lost its former resemblance to the instinct. This is markedly true of the so-called maternal instinct which, in content of activity in the

human being, has only a few remnants of the original maternal instincts of lower animal types.

But there would be no conclusive objection to this misuse of instinct if it brought good results. Its results are not good, but disastrous. The method has so far been barren of aid either to the investigator, to the teacher or to the social reformer. The educational psychologies, like the social psychologies, start out with an elaborate analysis of the so-called instincts and then solemnly inform the reader that the task of the educator is to guide these instincts into fruitful development as a method of adjusting the child to life; that it is the function of the school to develop the instincts instead of repressing them. A recent textbook in this field[1] illustrates the point. The elaborate analysis of instinct in this work, however, is not followed by a fulfillment of its promise. Specific instincts are mentioned only a few times after the introductory chapters are passed, and in this respect the book is not exceptional. The process of applying the instincts to the living educative process turns out in most of these books to be a very general and vague one. And so it is in the social psychologies. The applications have little of the exactness which characterizes the definitions of instincts.[2]

This inability in practice to make the development of the instincts fulfill the promise of the classification is not, however, a matter to occasion surprise. The social and educational psychologists have started to build their superstructures of individual character and social institutions upon too sophisticated and too unstable units. These units (supposed instincts) will not retain their form and character under the pressures of environment in the socializing process. Their contents are too fluid and indefinite. It will be necessary to divest the 'instincts' of their acquired content and to reduce them to the most ultimate possible terms. Then the psychologist, the educator and the sociologist can begin to use them as building stones of character out of which to construct the foundations and part of the superstructures of social life. The exposure of the present incorrect usage of instinct should

[1] Starch, 'Educational Psychology.'

[2] Compare in this respect the two volumes by McDougall: 'Introduction to Social Psychology' and 'The Group Mind.'

clear the field for a vastly more important labor of analysis in character and society building.

The real task before the social and educational psychologists is to discover the mechanisms by means of which the child and the citizen build up their habits upon the basis of the instincts, directly or indirectly, and by means of which one habit or set of habits is transformed into another. Hitherto they have approached this problem from essentially the wrong angle, that of the analysis of instinct, on the assumption that instinct dominates the development of habit. Both the approach and the assumption are erroneous. The sociologist is demonstrating that the environment increasingly dominates both the content and the direction or functioning of habit formation. It is, therefore, from the standpoint of the character and the organization of the environment that the control of the growth of human character should be approached, the instincts being regarded primarily as the original—not necessarily the immediate—starting points in the process. But before this change in emphasis can be brought about the inadequacy of the theory of instinctive control must be made manifest through an exposure of the current radical misconceptions regarding the nature and content of the instincts. Many sociologists have been feeling their way toward this objective for some time. It is a task which of necessity falls to the sociologist, because only he has the data regarding social organization and social pressures in sufficient mass and detail to make the error of the biological group—generally quite uninformed regarding the complexity and dynamic character of the social environment—sufficiently evident. It is not too much to say that the future control of the human race and its civilization lies not through selective breeding of the higher social qualities—although selective breeding of those traits which can be so bred is of the greatest importance—but through their transmission by social contact and control.[1] The overwhelming—and generally the immediate—pressures upon the character-forming process, especially in its more advanced stages, comes from the accumulated social environment.

[1] Cf. Conn, H. W., 'Social Heredity and Social Evolution,' Ch. 11.

AN ATTEMPT TOWARD A NATURALISTIC DESCRIPTION OF EMOTIONS. (II)

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VI

The Utility of Emotional Behavior.—One of the effects resulting from the growing influence which biological theories began to exert upon psychology in the middle of the past century, was the conception that emotions are definite adaptational reactions which promote the conservation of the individual. More than closely linked is this assumption of the self-preservative character of emotional conduct with the idea that emotions are inherited forms of response. Not the least surprising, then, is the fact that the utilitarian doctrine of emotional behavior is more prescriptive than descriptive, and brings in its train results that are most remarkable.

It is entirely possible that even the most careful observer of emotional behavior may needs come to the conclusion that much of such action must be interpreted as adaptational and useful. In particular, this might be the case with the glandular secretions which are so prominent in emotional behavior. But what right have we to base our conclusions upon a limited number of features? What of the looseness of the bowels, the retching and vomiting, the violent heartbeat and the innumerable other symptoms of emotional shock? Are these too of use in the organism's adaptations? And is there anything in the nature of a psychological act which prohibits us from considering the glandular reflexes as entirely fortuitous occurrences in the total complex pattern of response?

Further indications of the invalidity of the utilitarian theory come to the surface when we consider that in the cultural emotions organic functions are not nearly so promi-

nent, and apparently do not produce energy-giving secretions. And it is hardly convincing to say that in these secondary emotions the organic reflexes are not present because they are not needed, for by so doing one clearly makes utility synonymous with presence, and in consequence assumes what is to be established, since as a matter of fact even when the organic activities are present their utility is questioned.

Unfortunately the apparent serviceability of various strongly excited organic activities under certain circumstances has induced several writers to indulge in much indifferent speculation concerning the utility or general adaptive character of emotions.[1] Aside from the question whether these writers are observing emotions at all,[2] the objectionable feature of such speculation is the implication that organisms possess general mechanisms with definite purposive functions to meet unfavorable specific circumstances. The consequence of holding such a view is that it inevitably results in overlooking facts, such as the substituted character of the organic processes, which are not compatible with such a preconception.

The writer submits that, on the whole, observational evidence does not support the view that emotional disruptive shock is always or even in most cases beneficial to the organism, either at the moment or in the long run. As a record of fact, all that the study of emotions enables us to say is that under certain circumstances the emotional behavior is apparently a useful reaction in the sense that a very rapid and immediate response seems necessary, and it occurs. But, in just as many cases the dissociating and disruptive character of the emotional act may be the occasion for a very harmful result to the organism, and not infrequently the cause of its death. What chance would a person have in a difficult situation if he should be deprived even for a moment of the opportunity to offer a definitely centered and directed response to a pressing stimulus? It is evident, then, that

[1] Cf. Cannon, 'Bodily Changes in Pain, Hunger, Fear and Rage,' 1915. Note Cannon's hortatory defense of the martial virtues.

[2] Note the grouping of phenomena—pain, hunger, fear, rage.

emotional behavior is not always adaptable activity and consequently we must reject summarily any utility interpretation, especially since such an interpretation appears not to be based upon actual observation but upon the belief in a mental force or entelechy manifesting itself by physiological conduct.

VII

The Relation of Emotions to Instincts.—Current psychological opinion appears unanimously agreed that there is a very close connection between emotional and instinctive behavior. And the basis for the belief in such a connection lies in the observation that emotions are very direct and even elementary forms of behavior. It is only the fact of connection, however, that is concurred in, otherwise there is wide divergence of opinion concerning the precise relation between instincts and emotions. Thus, McDougall conceives of an instinct as a fundamental system of action including an emotion, whereas Shand thinks of instincts as being parts of the fundamental emotion.[1] In passing, we might suggest that the disagreement between McDougall and Shand is made possible by the fact that the distinctive feature of emotional behavior is a form of dissociation, a fact which makes possible differing views as to the specificity or generality of such psychological acts.

Still another disagreement between those who believe in the close relation between instincts and emotions concerns the exact stimulation of them to action. On the one hand, it is held that emotions are the affective accompaniments of instincts in some form (McDougall), while on the other, emotions are presumed to arise when there is delay or obstruction in the way of instincts toward carrying on their predetermined goal (Shand). Let it be noted, however, that in all cases the implication is forced upon us that our action is predetermined by some innate power. Now such a view

[1] All this for both in terms of mental structures. Cf. Shand, *Proc. of Arist. Soc.*, 1915, **15**, 74. "Primary emotion is at first a biological force pursuing its innately determined end by means of instincts and other dispositions organized with it." *Ibid.*, p. 75.

of human activity is entirely incompatible with any observation of behavior and leaves no place for the development of action and the conditioning of it by specific surrounding objects and persons. Our activities are not as a matter of fact the unfolding of purposes and ends but the responses to stimuli and their settings as they actually are found in our surroundings. Because we have no instincts in the sense of biological ends there can be no connection between instincts and emotions; this connection is impossible also, because actual instincts as found in animals and infants are definite response-patterns called out by specific stimulating objects; they are not in any sense tendencies which can conflict with each other.

No less significant than brilliant was the formulation which Dewey[1] made of the relation of emotions and instincts. Let us recall that Dewey was interested in the problem of substantiating James's doctrine of the priority of the organic changes (expressions) to the emotion proper by a reformulation of Darwin's statement of emotions and their expression. The reader will recall that Dewey interprets Darwin's expressions as "the reduction of movements and stimulations originally useful into attitudes," attitudes which apparently are conditioned by instincts. For Dewey the specific seizure or affect in an emotional situation is a conflict and tension of instincts or tendencies to action. "The emotion is *psychologically the adjustment or tension of habit and ideal*,[2] and the organic changes in the body are the literal working out in concrete terms of the struggle of adjustment." [3]

For us the significance of Dewey's doctrine lies precisely in the fact that it glaringly reveals the inevitable consequence of injecting into psychology such metapsychological entities as instincts. For mark you, Dewey cannot allow that the person is stimulated by a concrete object, for without the inhibiting tension an organism would not be making a response 'at' or towards an 'object,' [4] and so the conflict of instincts takes

[1] PSYCHOL. REV., 1894, 1, 553; 2, 13.

[2] Apparently the conflict of two or more instincts brings about the emotion.

[3] PSYCHOL. REV., 1895, 2, 30.

[4] *Ibid.*, 2, 28.

place as a mysterious ebullition in 'consciousness' out of which are differentiated both the stimulus and the response.[1]

Obviously the theory we have been summarizing cannot be employed to interpret the concrete disruptive behavior of actual human organisms, but we are interested to point out that possibly this is true of all instinct doctrines. The idea that emotions are conflicts of instincts or result from the conflict seems to us purely fanciful; and being based on so-called inner states it is in consequence entirely out of touch with concrete reaction conditions. Such a doctrine makes of emotions in some sense the inner side of instincts, while the latter are presumed to be the external phases of certain acts. In all theories of the close or inseparable relation between emotions and instincts, the former are presumed to be 'mental,' while the latter sometimes are and sometimes are not.

But after all such a widespread conception as that of the relation of emotions and instincts must have some factual basis, and truly enough a diligent search is rewarded by the means to account both for the asserted relation, and the belief in a conflict of tendencies.

And first as to the relation between emotions and instincts, the writer submits that the mentalists arrive at their interpretation by miscalling the substituted reflexes, in the emotional pattern of response, instincts. The motive for such a misinterpretation may be sought in the utilitarian conception of emotions, according to which all that occurs to the person must be looked upon as necessary happenings and never as fortuitous processes.

The conflict theory of emotions no doubt is based upon the observation that in some emotional situations a seizure occurs in the presence of a multiplicity of confusing objects; so that a simple response pattern cannot function without interference. Now the crude fact here is a conflict between stimulus objects and the concrete responses of the individual in contact with them, such stimuli and such responses being

[1] "The frightful object and the emotion of fear are two names for the same experience." *Ibid.*, p. 20.

natural objects and events. From an objective standpoint it seems a far cry from this crude fact to a conflict of mentalistic states. An interpretation of concrete movements of an organism can never be made out to be a conflict of permanent mental tendencies.

VIII

The Classification of Emotions.—If we agree to reject the belief in the relation of emotions and instincts, we at the same time renounce the latest of the perennial attempts to classify emotions.[1] And perhaps here we find a clue to the failure of all those attempts to segregate emotions under convenient rubrics. The clue is this, that psychologists could not find any common factor between the complex behavior of an organism and a presumed mental state, a fact which is otherwise expressed in the statement that there is no definite subjectivistic criterion for the classification of emotions.

From an organismic behavior standpoint, there is strictly speaking, of course, but one kind of emotion; that is to say, emotions constitute a class or type of action. The most obvious means, therefore, of classifying the various emotional activities is to correlate them with the exact circumstances under which they occur, and while the extreme complexity of these stimulating circumstances militates against our attaining at present any well rounded and compact classification, such a correlation will serve to give some behavior-content and meaning to the various divisions. Moreover, to describe an emotional act under the circumstances in which it occurs is to give it its stimulus-response setting and to keep our classification from resembling an enumeration of specific faculties.

The problem of ordering and arranging emotional acts involves us in precisely the same difficulties as the classification of thinking acts. In each case, however, the specification of the exact circumstances under which the person is responding will give us an insight into the operation of human reactions, besides helping us to understand the precise details

[1] Cf. McDougall, 'Social Psychology.'

involved in building up reaction systems. For instance, a comprehensive behavioristic study of the more subtle or refined emotions will afford us some insight into the intricate details of social behavior and the social modification of human action. Further, unless we plan to make such a comprehensive study of emotional activity we can find little promise of obtaining additional information about such behavior by the mere analysis of the secretory functions which play a prominent part in emotional acts as well as in other types of behavior. More value there would be in such an analysis if we considered the glandular secretions as integral parts of a large general response system in correlation with definite stimulating circumstances. It is something other than scientific wisdom to place one's hope for the classification of emotional conduct entirely in the physiological factors of behavior, as some writers do, to the neglect of the other components, and the stimulating conditions of the whole response.

Of cardinal importance it is for the classification of emotional conduct to be fully cognizant of the fact that whenever we persistently cling to a name as though it were something more significant than a name, we will inevitably falsify essential facts. Perhaps in no other domain of psychological science does a name mean quite so little or do so much harm as in the study of emotions. It is not surprising, then, that the literature on the subject amply reveals many difficulties of description and interpretation because such terms as fear, anger, joy, and sorrow are presumed to represent unique sorts of psychological facts. The truth of the matter is, that these names as commonly used stand not only for genuine emotional reactions but also for various other acquired human responses, such as feelings, besides the connate organized responses of animals and infants. Furthermore, let us not forget that besides standing for widely different forms of actual behavior, the names found in the writings on emotions represent mental states, each of which has a variety of expressions. Because names are so treacherous in the psychology of emotions, the needs of the science dictate that a closer examination be made of the behavior which is to be

classified, and that slighter attention be given to conventional names.

IX

Determining Conditions of Emotions.—Incomplete must always be the description of psychological phenomena unless we add to our report of the facts of stimulus and response also the conditions under which the latter interact. The necessity to investigate the precise conditions influencing responses appears from the fact that any reaction depends as much upon the constitution of the individual and the character of the surroundings as upon the bare presence or absence of reaction systems and stimuli. In the case of the emotional situation the disruptive chaos can obviously be avoided by the substitution of an overt response for one that is lacking, provided that the surroundings are propitious, and the person is in a prepared condition for such an emergency.

Although there is great difficulty in specifying the exact determining conditions of emotional conduct we can, however, isolate a few factors which have a contributory effect in bringing about or preventing an emotional reaction. We may call these constitutional and stimulating conditions, respectively, inasmuch as they refer primarily to the condition of the person or the surroundings.

1. Among the constitutional conditions we might enumerate the following. (*a*) The primary constitutional condition of emotional behavior involves the fact of psychological equipment. A person who is thoroughly equipped with response patterns for the various situations in which he finds himself will be decidedly less liable to be thrown into a situation of no-response. Further, the student who had previously prepared himself in his learning task would be much less liable to suffer a surprise emotion when confronted with a difficult examination. (*b*) Closely related to the previous condition is the speed of reaction of the person. Ordinarily an individual who is not quick to improve upon a situation confronting him will be liable to be caught in a dangerous or undesirable position. The person who would begin to act rapidly in the presence of a dangerous object, possibly to

inhibit movement, or to substitute another overt adjustment, would be much less apt to suffer disruption of his actions. The person who is clever at repartee will seldom if ever suffer an embarrassing moment. In this type of situation as in some of the elemental situations the self-confidence of the person is an extremely potent factor in the prevention of emotional disturbance. (*c*) The ability to avoid an emotional shock depends upon the general physiological condition of the person, since the capacity of the person to handle his reactional equipment varies with his physiological states. A person who is just recovering from an illness may be for the time being inadequately equipped to grapple with a dangerous natural situation. Similarly, to be overworked, nervous, or discouraged, means a special liability to undergo emotional shock. In these cases as in all others we must observe that the constitutional condition only has direct reference to the stimulations at hand. (*d*) Another influence of emotional conduct is the present condition of an individual which is due to the circumstances of an immediately preceding emotional situation. Thus the same or a similar stimulus may now influence the person not to suffer an emotional disturbance at all, or to experience a mild rather than a violent seizure.

2. The stimulation conditions of emotional behavior are very numerous as we might expect. (*a*) One of the outstanding conditions would be the familiarity of the person with the stimulating objects and their settings. When stimuli are known and not strange they are less liable to bring about a dissociation or disturbance in the person. One is seldom overawed or overwhelmed by familiar surroundings, and in a sense this is obvious when we consider that familiar surroundings mean that we have developed definite integrations of stimuli and responses. (*b*) Prominent as a contributory factor to social emotions is the presence of certain persons; a reproof or a *faux pas* in the presence of some relation, loved, or admired or feared individual will often result in an emotional behavior, whereas the absence of such persons may mean the avoidance of such a result. In general, the

emotional disturbance is conditioned by the setting of the stimulus object, so that while the person may know what reaction to make to an object alone or under certain circumstances he may have no response for the object in its present setting. (*c*) It follows then from the character of the conditions of emotional behavior that a potent preventive of emotional seizure is a frequent contact with any given situation and especially a situation which, through recent experience, has shown itself capable of inducing an emotional disturbance.

X

Emotions in Animals and Infants.—Throughout the entire modern subjectivistic tradition psychologists have always assumed that animals have emotions as well as other states of consciousness. Especially since Darwin's time, in which the continuity of species became the dominant motive in the biological domain, the view has prevailed that human emotions are really vestigial remnants of the emotions which the animal ancestors had acquired. Naturally enough such a mental states doctrine conduces to obliterate the distinction between emotional actions proper, and other types of feeling behavior, and as a consequence animals are endowed with reactions which, because of their organization and development, they, in common with infants, obviously cannot have. How anyone can ascribe to animals and infants such complex reactions as can only be acquired in a long social experience, is suggested to us in the thought that probably psychologists are reading back into the actions of children and animals motives and conditions of behavior which they find in themselves. How illegitimate such a proceeding is may be judged from the fact that a critical observation of the actual responses to stimulating circumstances convinces us not only that animals never have any social emotions, but also that they seldom if ever develop to the stage of performing even elemental emotional behavior.

Since the present status of psychological opinion concerning emotions in animals has its roots in the Darwinian

influence upon psychology, it would not be amiss to digress at this point in order to trace out the growth of the conception that man and animals have the same types of mental states. And first let us observe that Darwin accepted the biological similarity between the human and animal organism as the basis for a correlation between the expressions of emotions in the two cases. What seemed to be similar 'expressions' were then taken to refer to similar mental states. What Darwin and the other writers overlooked in their thinking was that they were not observing expressions of any mental state but rather direct animal responses of an instinct sort to specific stimuli. They, however, named these responses by applying conventional terms,[1] and in this way animals began to be endowed with all types of emotions and other sorts of feelings. Finally, this mode of thinking developed to the extent that Darwin[2] could write that 'man himself cannot express love and humility by its external signs, so plainly as does a dog.' Clearly we have here as flagrant a piece of anthropomorphism as one would care to find, even in such a culpable writer as Darwin is in this direction.[3] An excellent example of Darwin's uncritical views concerning the psychology of animals is found in his acceptance of Mr. Bartlett's statement concerning the knowledge and cautiousness of hyenas. "They well know that if one of their legs were seized, the bone would instantly be crushed to atoms." What one gathers from such a statement as was just quoted, and Darwin's remark about the value of observing infants in order to ascertain how far particular movements and gestures are really expressions of certain states of mind,[4] is that he was probably dealing with two different sorts of phenomena. He was considering human feeling behavior on the one hand and animal instincts on the other, but Darwin is misled by

[1] What can be meant by 'insulting' a monkey? Darwin, 'Expressions of the Emotions,' p. 137.

[2] *Loc. cit.*, p. 10.

[3] One is strongly reminded here of Darwin's violent assumptions concerning the exalted æsthetic development in animals as described in connection with his theory of sexual selection.

[4] *Loc. cit.*, pp. 13, 122.

his conception of emotions and expressions to make the two identical.[1]

Among the many evidences which we might quote from the 'Expressions' to indicate this identification is Darwin's statement, that because the tender feelings are compound states and not simple feelings he could mention only weeping as their expression.[2] Also to the point here is the statement that blushing is the expression of many 'emotions' (shyness, shame, modesty) which are grouped under a single heading, namely, self-attention, no doubt, mainly as a heroic effort at correlation.[3] Do not these facts typify Darwin's inappreciation of the incongruity between critical observation of behavior and of forced injection of the continuity doctrine into the conventional and anecdotal tradition concerning emotions and their expressions?

If such be the case, is it not strange that current psychologists so readily accept the mentalistic continuity doctrine with its implication that emotions are persisting potencies which operate as properties of men and animals.[4] Here is evidence that about as much violence can be done to scientific facts by the uncritical acceptance of a continuity as of a discontinuity doctrine. A careful study of actual behavior discloses definite continuities in the activities of man and animals occasioned by similar organization and common external surroundings, but there are none the less just as definite discontinuities between the two types of organisms due to disparities of biological and psychological development and differences in surroundings. At the point of emotional behavior it is safe to say that observation discloses indefinitely more discontinuity than continuity.

In fairness we must add that Darwin did not entirely

[1] As Dewey (PSYCHOL. REV., 1894, 1, 555) so well expresses it, "In the discussion of movements in animals (pp. 42–48), the reference to emotions is not even nominal. It is a matter of 'satisfaction of desire' and 'relieving disagreeable sensations'—practical ends."

[2] *Loc. cit.*, p. 214.

[3] At the basis of the difficulties here is an implied acceptance of a structuralistic psychology.

[4] When not based upon observed facts such a doctrine would of course be a metaphysical proposition.

miss the difficulty of his views, for he says that love (maternal)[1] and practically all the complex feeling acts[2] have no characteristic expressions. But although this admission on Darwin's part implied a doubt as to whether the crude activities of animals and the refined behavior of human individuals are similar, his authority seems to be so incontestable as not to arouse comment when he implies that abstraction, denial, affirmation, and meditation are emotions, the expressions of which can be analyzed.[3] A slighter indication that Darwin suspected that all was not well with his formulation, to the effect that characteristic expressions exist for the emotions, is found in his report that when persons are confronted with photographs of expressions, they are not always able to attach the expressions to the emotions which they are supposed to express. For fear, however, that this would be too great a disturbing factor in his work, Darwin ascribed this inconstancy of the relation between the emotions and its expression to the misguidance of the imagination.[4]

Most incomprehensible it is that psychologists are not more sceptical of the doctrine that animals have emotions, if it is true that such a doctrine is based upon the sort of thinking we have been indicating. Surely there can be no question as to the vulnerability of Darwin's psychology. To indicate but a few weak spots we might ask how plausible it is that animals should voluntarily acquire emotional expressions. Further, what value can a theory have that fails to distinguish between thinking, and emotions and other types of feeling behavior. Again, we might ask whether such crude transmission of acquired behavior as Darwin supposes is consonant with observable facts. Hence, we might conclude that if the belief that animals have emotions is based upon the Darwinian foundation, it lacks much in scientific validity.

[1] *Loc. cit.*, p. 213.

[2] Called by him states of mind, *loc. cit.*, p. 261.

[3] From a subjectivistic standpoint, Darwin's performance is much mitigated, since after all what he is attempting to do in this book is to correlate the 'mental' and the 'physical.'

[4] *Ibid.*, p. 14.

But let us turn to the actual observations themselves, for we must not dismiss the problem without an attempt to examine some types of animal behavior which appear to have some resemblance to the emotional activity in human beings. Consider the action of the chipmunk stimulated by footsteps approaching from the rear, while he is calmly nibbling at some garden green. Immediately there is a start and shift of position while the animal turns to face squarely the approaching object; then scampers towards his hole or other place of safety. Now much as the activity just described may resemble an emotional situation, a careful examination of the details indicates no breakdown of stimulus-response coördination. The start observed is nothing but the ordinary change of attitude which we find in all attention responses. In fact this attention start, which superficially appears like an emotional phase of behavior, is always found present and in addition to the emotional phase in all actual emotional conduct; in sequence it precedes the emotion-initating perceptual or ideational process. Far from proving the presence of emotional behavior in animals, the attention-start points to the possibility of describing whatever activity we find in animals in their ordinary surroundings by referring to the practically full complement of congenital response systems with which they adapt themselves. Such acts as the attention-start the animal is uninterruptedly performing during each hour of its active life, and this fact would seem to indicate that these responses are due to a definite form of response system.

And now we may inquire into the findings of physiological research for light upon the problems of emotions. In particular, we might expect to gain some information from such experiments as are designed to test the Jamesian theory of emotions.

Unfortunately physiologists are parallelists and their work is seriously compromised by the assumption that in an emotional activity the organic changes are either the cause or the outcome of a psychic state called the emotion. Cannon[1] proposes to discover by the study of animals what

[1] 'Bodily Changes in Pain, Hunger, Fear and Rage,' 1915.

bodily results follow the functioning of the fundamental 'agencies which determine the actions of organisms.' And Sherrington[1] aimed to test the view 'that the psychical process of the emotion is secondary to a discharge of nervous impulses into the vascular and visceral organs of the body.' The unhappy feature of such work done on the parallelistic basis is the immediate setting aside of the so-called psychic factor and the confining of one's efforts to the exclusive investigation of the organic phases of behavior. In consequence, the essential differences in behavior are entirely overlooked and the assumption of a continuity in the behavior of man and animals results in endowing the latter with activities that are really found only in the former. In general, we might say that the physiologists have really been studying (1) visceral reflexes in pain, hunger, and fear-rage instinct behavior,[2] and (2) the relative functioning of the cephalic and more posterior portions of the organism in instinct action,[3] but not emotions.

Sherrington's conclusion from his experiments not only does not militate against the James-Lange-Sergi theory of the emotions, but on the contrary offers some evidence that he is not occupied with emotions at all. His discussion reads much like a tremendous overemphasis of psycho-cephalic parallelism and nothing more. The transection of cord and vagus cannot prove that emotions are cerebral processes, since the supposition that there exists an emotion in the form of a psychical adjunct has absolutely no basis in any observable fact. On the contrary, physiological experiments do appear to confirm the view that psychological behavior is the activity of the whole complex organism. Now the experiments seem to indicate that depending upon the intricacy of the behavior, the reaction systems may function when the organism is only partially coördinated. This fact is substantiated by Goltz's[4] decerebrate dog which 'showed' anger, but not fear, joy, and affection. May we

[1] *Proc. of the Royal Society*, London, 1900, p. 390.
[2] Cannon.
[3] Sherrington.
[4] Quoted by Sherrington.

not then assume that the animal behavior studied by Sherrington was really a series of instinct responses and not at all emotions similar to those found in the human species? The writer hastens to add that he accepts in its entirety the description of the behavior of the dogs which Sherrington has published, but reserves the right to reinterpret the terms joy, disgust, friendliness, so as to exclude completely the objectionable anthropomorphic implications. This reservation is necessary in view of the unfortunately extreme poverty of psychological language with which to describe animal reactions. Indeed, could Sherrington set aside his psychocephalic parallelism, he would be very sympathetic with our view concerning the absence of emotions in animals, since he writes that 'there is no wide interval between the reflex movement of the spinal dog whose foot attempts to scratch away an irritant applied to its back, and the reaction of the decerebrate dog that turns and growls and bites at the fingers holding his hind foot too roughly.'[1] Is it not true that in both cases we have the operation of truncated response mechanisms of precisely the same sort which Sherrington himself describes as pseudaffective reflexes?[2]

When we turn to the problem of emotions in infants we find a similar dearth of conditions capable of giving rise to emotional disturbances. Watson's studies of infants demonstrate the absence in the conduct histories of young children of the characteristic chaotic or no-response conditions, with the replacement of visceral and other reflexes. Watson does not agree with this view, however, and indeed believes he has found in infants three types of emotions, but our reading of his material convinces us that he has looked for and found only some specific instinct responses. The names he gives to these instinct responses, 'fear,' 'rage,' 'love,' seem to us to be arbitrarily applied and interchangeable.[3] In fact, when Watson's descriptions of the infant's responses are read to various persons, there is no general agreement as to the

[1] 'Integrative Action of the Nervous System,' p. 266.

[2] *Ibid.*, p. 251 ff.

[3] We are here reminded of Sir Charles Bell's assertion that animals 'seem chiefly capable of expressing rage and fear' (quoted by Darwin, *op. cit.*, p. 10).

appropriateness of the names he applies.[1] Although Watson[2] definitely asserts that an emotional act differs from an instinct by the occurrence of a momentary shock, his disregard of the differences between emotions and other feeling acts, not involving disruptive shocks, betrays him into making emotions into hereditary patterns of response. In this manner he obliterates the boundary between emotions and instincts, and moreover by invoking the criterion of non-training for hereditary acts he achieves the result that we have already described, namely, a discovery in infants of three kinds of emotions. The upshot of this procedure is that Watson veers considerably from the objective position and tends to interpret infant behavior, not from the standpoint of actually occurring responses to specific stimulating conditions, but as the manifestations of hereditary tendencies. What observer can overlook the differences between actual emotional behavior and comparatively simple positive responses which are offered to such stimuli as restraining, pulling a blanket away, striking, etc., responses which may just as well be called habits as emotions. We insist that while the failure of a stimulus-response coördination among older infants begins to be possible, because they have been acquiring responses to stimuli, yet it is true that as a matter of fact genuine emotional conduct will be an extremely rare occurrence.

XI

Emotions and Expressions.—As we have previously intimated some of the difficulties we encountered in the study of emotions in animals and infants are due to the still prevalent implication that in emotional reactions what we observe is an outward expression of a mental state called an emotion. Singularly enough, although Dewey[3] had long ago pointed out that expressions could have no meaning so far as the acting

[1] That is to say, when the persons who hear the description take the names to refer to emotional reactions. It is true, of course, that the names may be entirely appropriate for the reactions studied, but in that case we assume that the names symbolize a variety of behavior.

[2] 'Psychology,' p. 196.

[3] PSYCHOL. REV., 1894, 1, 555.

individual was concerned, the parallelistic conception of psychological behavior has to this day kept alive the inner-outer conception of emotions.

Illustrative of the influence which subjectivism exerts upon our minds is the fact that in the same papers[1] in which Dewey abjures emotional expressions, he employs himself in the defense of James' 'paradox' concerning the order of apparition of the invisible emotion and its visible physiological colligate. No doubt the reader recalls that the motive for this defense was Dewey's attempt to translate a philosophical conception into the biological terms which James's theory supplied. Dewey really meant to demonstrate that feelings are the internalizing of activity or will in the sense that an emotion is a report (feeling) in consciousness of an act previously performed.

But our purpose is not to revisit the scene of former battles; rather we wish to point out that when we stray from a description of actual behavior, the 'expressions' remain in our thinking, much disguise them as we may. Has Dewey avoided an unpsychological dualism by calling an emotion not an expressed entity, but a repercussion in consciousness of an organic happening? It is our opinion that Dewey has merely placed in relief a psychophysiological parallelism which at the point of emotions inspired James very little. For this reason Dewey could write[2] that "Prof. James himself does not seem to me to have adequately realized the inconsistency of Darwin's principles, as the latter states them, with his own theory." From that day to this the dualism has persisted through a multivaried modification of the expressions of the emotions to a serious neglect of the actual behavior of the person under the various conditions of emotional stimulation.

When emotions are studied as concrete behavior, we find absolutely no warrant for including in our description of them any dichotomy between the emotional acts and their expression. Moreover, there is no meaning in the question whether emotions precede or follow the expression. We

[1] PSYCHOL. REV., 1894, 1; 1895, 2.
[2] PSYCHOL. REV., 1894, 1, 554.

might just as well ask whether the perceptual action of another person precedes or follows our observation of it. It is obvious, therefore, that the emotion-expression dichotomy may be entirely rejected irrespective of the specific interpretation one makes of emotional behavior. We are inclined to believe that this dichotomy goes back in the final analysis to a non-naturalistic psychological hypothesis.

XII

Summary.—Unlike any other type of behavior the emotional reaction is not a positive response to a stimulus, but rather a failure of a stimulus-response coördination to operate. What happens is that the organism is left in a crucial situation (in the most striking cases) without certain expected or desirable means of adaptation, either because of not having a response system for the particular stimulating circumstances or because of some failure of such an acquired response system to operate. Emotions are therefore essentially 'no response' activities. The individual thus left without a directed mode of adjustment is thrown back upon primary responses, namely, organic reflexes. It is these replacement reflexes which give emotional conduct the appearance of positive adjustments. From this it follows that emotional conduct must not be interpreted as hereditary forms of adaptational activity, since emotions are either due to the break-down of an acquired stimulus-response situation or the absence of such a coördination which should have been developed to meet the needs of the present situation. The criterion for what reaction systems should have been developed depends upon the observation of those definite reactions the individual has actually acquired, namely, the precurrent perceptual responses. The latter, however, are not complete for the present situation without the consummatory reaction systems that are not operating at the time, but which apparently should have been acquired contemporaneously with the precurrent responses. Our criterion is of course based upon the apparent concrete needs of the individual at the moment, and is therefore frankly ephemeral, since the needs of the indi-

vidual can only be determined by a field observation of the emotional reaction.

One of the significant results of the reactional interpretation of emotional conduct is that it forces to the front the distinction between emotions and feeling behavior. Fundamental in such a distinction is the fact that, unlike emotional conduct, feeling behavior of every type always involves the operation of definite response systems. A fact it is that almost every segment of behavior in which is found an emotional phase, will also include one or more feeling reactions, but in every instance the observer can adequately discriminate between the two types of conduct.

A natural consequence of the negative character of emotional behavior is that such action cannot be of general and necessary utility to the organism. In no sense can emotions be considered as determining adjustments of any kind whatsoever. Although it may sometimes occur that the disruptive dissociation of the emotional reaction may turn out to be a benefit to the person, yet such a consequence must be considered as a wholly fortuitous circumstance, and in general emotions must never be thought of as permanent directive agents which serve to carry the person through the intricate maze of daily events. On the contrary, emotional conduct is always truncated and ineffectual action, and can be useful only in elementary situations where the replacement reflexes can be of service.

Because emotions are negative or 'no response' actions, they cannot very readily be classified. Although the psychologist has trouble in grouping and correlating such behavior, this very fact is of extreme importance to the student of psychological phenomena, in that he is necessarily forced to study the emotional situation precisely as it occurs; and so the classification of emotional conduct must be based upon definite stimulus-response conditions, a fact making for exact and accurate, though extremely difficult, classification. Probably the most valuable result to be derived from such a work is the freeing of emotional conduct from their presumed dependence upon those teleological entities called instincts.

It follows from the dissociative and disruptive character of emotional behavior that emotions are seldom if ever found in animals and young children, since such organisms have not reached the stage of acquiring sufficient response systems to become disrupted. In animals and in infants the organic reflexes and other factors common to emotional reactions are parts of behavior segments which are positive responses to stmuli and are not replacement acts at all. An analysis of the behavior of animals and infants does not reveal conditions of a precurrent response failing to elicit its appropriate consummatory reaction, with the consequent replacement of this final act by organic reflexes as the only available mode of adjustment.

On the whole, it is hoped that such an organismic hypothesis as we have proposed will throw into clearer relief what has always appeared as an extremely baffling psychological phenomenon. Upon the basis of such a naturalistic standpoint emotions become familiar to us not as products of theory, but as vital modes of an organism's responses to disrupting conditions of its environment.

ON THE ORGANIZATION OF INTELLECT

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If we measure a group of men or children in respect to a random sampling of intellectual tasks, and score each on a scale running from low to high, or bad to good, using those terms in each case as psychologists or sensible persons in general would use them, we find two notable facts. All or nearly all the inter-correlations are positive. The inter-correlations range from low to very high values.

The first fact demonstrates that the net result of nature and nurture upon individual differences in intellect is not to compensate for weaknesses by strength, but to retain in respect to total intellect much of the variability found in any one segment or element or feature of it. The second fact directs us to search in the facts of inter-correlation for the principles according to which intellect is organized in nature originally and as a result of nurture's modifications.

As a result of his search, Spearman ('04) early announced the theory that one unitary factor is alone largely responsible for the positiveness of the correlations. The first statement of the theory was as follows ('04, p. 84): "All branches of intellectual activity have in common one fundamental function (or group of functions) whereas the remaining or specific elements of the activity seem in every case to be wholly different from that in all the others." This statement should be interpreted in the light of the following explanation (Hart and Spearman, 1912, p. 58 f.):—

"The opponents of the theory of a General Factor have taken this as claiming to be the *sole* source of correlation. Such an absurd claim does not seem really to have been advanced by any one. The earliest announcement of the principle was accompanied by a warning of 'its inevitable eventual corrections and limitations.' Special emphasis

was laid on the fact that correlation between performances is also produced by great similarity between them. Obviously, as the similarity tends towards completeness, the correlation must tend towards unity. This fact was underlined by actual examples in numerical detail. For instance, the correlation between Latin translation and Latin grammar was shown to be far too large to fit into the theory, and this was attributed to the content being the same in both cases, namely, Latin. Another instance of the same sort was French prose and French dictation. A further one was furnished by the test of counting letters one at a time and that of counting them three at a time; here, there was a close similarity both of content and form, and accordingly this was pointed out as the cause of the principle becoming invalid.

"It was never asserted, then, that the General Factor prevails exclusively in the case of performances too alike: it was only said that *when this likeness is diminished* (*or when the resembling performances are pooled together*), *a point is soon reached where the correlations are still of considerable magnitude, but now indicate no common factor except the General one.* The latter, it was urged, produces the basal correlation, while the similarities merely superpose something more or less adventitious. Up to the present, however, these similarities seem to have exercised surprisingly small influence. In all the performances dealt with in the next section, only three times did any of them resemble each other closely enough to require pooling; these cases will be discussed in detail later on."

His most recent statement of it is:

"The purport of this theory is that the cognitive performances of any person depend upon: (*a*) a general factor entering more or less into them all; and (*b*) a specific factor not entering appreciably into any two, so long as these have a certain quite moderate degree of unlikeness to one another." (Spearman, '20.)

To the genius of Spearman we are indebted for a test or criterion of the truth of this theory in the form of the correla-

tions of the correlations. If the theory is true, there will be an approximation to $r_{ap}/r_{aq} = r_{bp}/r_{bq}$, where a, b, p, and q indicate any of the tests in any set whence any that happened to be very obviously like others in the set have been eliminated; and in the corresponding table of correlations every column will have approximately a perfect correlation with every other column.

We have considered the correlations obtained from time to time in various studies at Teachers College from the point of view of Spearman's theory, and have in general not been able to corroborate it. The most extensive data at our disposal (McCall, '16) seemed decidedly adverse.[1] However, the facts in our material, as in that used by Spearman himself, were so complicated by the large probable errors of the intercorrelations themselves that it seemed best to search further.

What is desirable for the purpose is a table of intercorrelations—(1) for a fairly large number of traits, (2) from a very large number of individuals, (3) measured so accurately that the disturbing effect of corrections for attenuation is slight. I have at length found material which is very satisfactory in respect to (1) and (2). How well the third requirement is met I cannot say. Since Spearman authorizes the use of raw correlations, the matter is perhaps not so important as it seems to me.

It is the business of this paper to present the results of the application of Spearman's test or criterion to data from fifteen tests of 'intelligence' given to about 800 soldiers, and to seven tests of 'intelligence' and 'intelligence mixed with

[1] Spearman suggests ('20, p. 171) that in McCall's data "the intercolumnar correlation is always + 1.00, so long as the reservation is made, that the units of measurement should be chosen suitably. By this reservation, the positive sign can at once be restored throughout the intercolumnar correlations of both Webb and McCall." This seems to be an error; for changing the scoring so that, say, high scores on number checking are called minus and low scores plus, while it makes some of the intercolumnar correlations that were negative became positive, makes others which were positive become negative. No choice of the units of measurement that I can discover can make all the low negative intercolumnar correlations positive, unless it be one directed *ad hoc* and resulting in such absurdities as scoring a person as of less and less intelligence in adding the better he adds.

skill' given to over 900 soldiers. This material is perhaps better suited to the purpose than any that has hitherto been used.

I. The Case of the 15 Tests in the Army Alpha and Beta

The first facts are the intercorrelations of the eight tests of the Army Alpha and the seven tests used for the score in the Army Beta, as shown in Table I. For these I am indebted to Dr. Yerkes and the Division of Psychology of the Office of the Surgeon General.[1]

TABLE I

	Alpha								Beta						
	Directions	Arithmetical Problems	Common-sense Questions	Synonym Antonym	Disarranged Sentences	Number Completion	Analogies	Information	Maze	Cube	Rhythm	Symbol-digit Substitution	Number Comparison	Picture Completion	Geometrical Construction
	1	2	3	4	5	6	7	8	1	2	3	4	5	6	7
ALPHA:															
1.....		.652	.468	.554	.573	.541	.713	.573	.421	.515	.509	.573	.482	.543	.328
2.....			.645	.651	.659	.645	.569	.663	.386	.520	.612	.600	.564	.520	.305
3.....				.669	.622	.490	.500	.595	.283	.353	.423	.573	.479	.440	.191
4.....					.691	.499	.436	.746	.299	.347	.408	.481	.396	.408	.159
5.....						.510	.539	.718	.316	.400	.443	.495	.458	.447	.264
6.....							.505	.554	.313	.459	.465	.461	.466	.395	.211
7.....								.546	.285	.270	.395	.457	.393	.336	.229
8.....									.301	.381	.491	.570	.499	.521	.252
BETA:															
1.....										.428	.451	.427	.342	.501	.292
2.....											.566	.494	.443	.509	.376
3.....												.625	.647	.125	.346
4.....													.670	.588	.336
5.....														.485	.327
6.....															.340
7.....															

These fifteen tests have the special interest for our purpose that all of Alpha were selected by psychologists to make a good team of tests of general intelligence. Consequently

[1] Any reader who is not familiar with the fifteen tests in question will find them described in Army Mental Tests, by Yerkes and Yoakum, pp. 53 to 90 and p. 205 ff.

these eight should, in as far as the psychologists did their work well, give due representation to the factors important in intelligence, and should not include any two tests that were unduly alike in any 'specific' factors and so would diminish the value of the team by overweighting those 'specific' factors.

Those of Beta were selected for the same purpose, with special attention to correlation with Stanford-Binet scores, but with, of course, the requirement of non-verbalness. We have, then, fifteen tests, all representing cognitive performances, all chosen with the aim of emphasizing general factors, and with no test in either set 'very obviously like any other' in that set to a much greater extent than any one is like any other in the set.

TABLE II

CORRELATIONS OF THE COLUMNS OF TABLE I

All entries represent thousandths.

	Directions	Arithmetical Problems	Common-sense Questions	Synonym Antonym	Disarranged Sentences	Number Completion	Analogies	Information	Maze	Cube	Rhythm	Symbol-digit Substitution	Number Comparison	Picture Completion	Geometrical Construction
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
1.		669	743	570	668	834	770	672	013	−131	132	294	355	098	−245
2.			899	881	889	982	824	903	−101	039	241	575	532	064	−551
3.				924	938	863	702	946	−203	−063	061	452	438	253	−647
4.					736	734	836	941	−262	−037	212	479	412	312	−648
5.						878	780	861	−357	−205	177	442	095	229	−422
6.							819	824	−058	091	315	641	504	202	−289
7.								741	−157	168	277	433	392	302	−356
8.									−185	−055	078	410	366	112	−642
9.										924	−129	488	679	015	984
10.											189	533	692	−026	885
11.												302	464	854	252
12.													914	049	456
13.														−029	393
14.															129

The correlations of these columns of correlations were worked out following in every respect the requirements as to reliability and the allowances for disturbing effect that are specified by Spearman ('14). The results appear in

Table II in detail and in Table III for summary view. The correlations of the columns do not approximate + 1.00, but vary from − .65 to + .98 with a mean at + .35. The mean of any of the verbal tests with any of the non-verbals is near zero.

TABLE III

	Any One Alpha Test with Any Other Alpha Test	Any One Beta Test with Any Other Beta Test	Any Alpha Test with any Beta Test	Any Test with Any Test
−.90 to 1.00..				
−.80 to .90..				
−.70.....				
−.60.....			3	3
−.50.....			1	1
−.40.....			3	3
−.30.....			3	3
−.20.....			6	6
−.10.....		1	4	5
− 0.....		2	4	6
+ 0.....		2	8	10
+.10.....		2	4	6
+.20.....		1	6	7
+.30.....		2	5	7
+.40.....		3	5	8
+.50.....	1	1	3	5
+.60.....	3	2	1	6
+.70.....	7			7
+.80.....	11	2		13
+.90.....	6	3		9

II. THE CASE OF 7 TESTS OF INTELLECT AND SKILL

The data are the intercorrelations for an entire regiment of over 900 men, shown in Table IV. The group examination *A* is substantially the same as Alpha plus a test in memory of digits and a test in finding the largest and smallest in a column of ten numbers. The Ruger puzzles are a series of mechanical 'take-apart' puzzles of the general type described in the 'Psychology of Efficiency' (H. A. Ruger, '10). The other tests are described in Army Mental Tests (p. 105 ff.) For these data also I am indebted to the Division of Psychology of the Office of the Surgeon General.

These tests would probably be classed as tests of cognitive performance. The Stenquist test in assembling a simple wrench, chain, bell, lock, etc., is called a test of skill and does involve manual dexterity as well as mechanical insight. The Ruger puzzles involve some persistence and skill in

manipulation, but if psychologists had to choose between classifying them as cognitive performance and as motor performance, they would choose the former. The others are stock tests of intelligence.

TABLE IV

CORRELATIONS OF THE INDIVIDUAL SCORES, ADULT SOLDIERS; AN ENTIRE REGIMENT, $n > 900$

	Group Exam. *A*	Stenquist Skill	Porteus Mazes	Ruger Puzzles	Pyle Digit-symbol	Terman Designs	Cube Construction
Group Exam. *A*		.475	.456	.371	.782	.538	.158
Stenquist skill	.475		.485	.427	.530	.495	.509
Porteus mazes	.456	.485		.296	.529	.496	.396
Ruger puzzles	.371	.427	.296		.237	.297	.264
Pyle digit-symbol	.782	.530	.529	.237		.600	.475
Terman designs	.538	.495	.496	.297	.600		.439
Cube construction	.158	.509	.396	.264	.475	.439	

The correlations of the columns were computed according to the specifications of Spearman, with the results shown in Table V. They range from 1.00 (for Stenquist assembling test with Porteus mazes, Stenquist with Terman de-

TABLE V

CORRELATIONS OF THE CORRELATIONS OF TABLE IV, BY COLUMNS, CORRECTED AS SPECIFIED BY SPEARMAN ['14]

	1	2	3	4	5	6	7
	Group Exam. *A*	Stenquist Skill	Porteus Mazes	Ruger Puzzles	Pyle Digit Symbol	Terman Designs	Cube Construction
1		.450	.712	− .157	.365	.685	.625
2			.996	−2.560[1]	.880	.996	.846
3				− .121	.831	1.004	.585
4					.392	− .263	−.226
5						.954	.722
6							.332

signs, and Porteus with Terman) to negative values (for Ruger puzzles with all the others save the Pyle digit-symbol test). The mean (counting the extreme negative case as − 1.00) is .46. If we leave out the Stenquist and Ruger test, retaining only the stock tests of intelligence, the correlations range from 1.004 to .332 with a mean of .68. There

[1] The uncorrected value is −.917.

is here again no approximation to 1.00—no support for the theory.

III. The Case of 9 Tests of Intellect

The Spearman correction by

$$R_{ab}' = \frac{S(\rho_{xa}\rho_{xb}) - (n-1)\overline{r_{ab}\sigma_{xa}\sigma_{xb}}}{\sqrt{S(\rho_{xa}{}^2) - (n-1)\overline{\sigma_{xa}{}^2}}\ \sqrt{S\rho_{xb}{}^2 - (n-1)\overline{\sigma_{xb}{}^2}}}$$

is laborious and has been attacked as unfair by Thomson ('19). Where the number of cases is large it may be fairly satisfactory to omit it. This shorter procedure I have used

Table VI

Intercorrelations of Beta Tests
(653 English Speaking Cases)

	Maze	Cube	Rhythm or XO Series	Substitution	Number Comparison	Picture Completion	Geometrical Construction	Spot Pattern	Stanford Binet
	1	2	3	4	5	6	7	8	
1...		.477	.522	.514	.457	.490	.510	.476	.465
2...	.477		.632	.576	.560	.556	.592	.551	.545
3...	.522	.632		.689	.670	.584	.597	.619	.614
4...	.514	.576	.689		.766	.654	.584	.695	.639
5...	.457	.560	.670	.766		.619	.521	.703	.622
6...	.490	.556	.584	.654	.619		.555	.569	.586
7...	.510	.592	.597	.584	.521	.555		.559	.610
8...	.476	.551	.619	.695	.703	.569	.559		.572

Table VII

Correlation of the Correlations of Table VI. N = 653. Uncorrected. For Beta Tests and Binet

	1	2	3	4	5	6	7	8	Binet
1. Maze		.88	−.03	−.51	.15	.09	.73	.03	.37
2. Cube			.56	.27	.27	.39	.88	.32	.73
3. Rhythm or XO Series Completion				.62	.73	.95	.56	.73	.70
4. Substitution					.95	.90	.15	1.00	.77
5. Number Comparison						.95	.39	.95	.66
6. Picture Completion							.27	.90	.90
7. Geometrical Construction								.15	.26
8. Spot Pattern									.94
9. Stanford Binet									

with the correlations for 653 individuals tested with the Stanford revision of the Binet tests, and with the seven Beta

tests noted above, and also with test 8 of the Beta (a 'Spot Pattern' memory test). For this material also I am indebted to the Division of Psychology in the office of the Surgeon General. The data appear in Table VI. the correlations of the correlations are shown in Table VII. The mean is .54 for all; for tests 1 to 7 it is .48.

General Considerations

The results above are obviously in better agreement with the views of Thomson ('16, '19*a*, '19*b*, and '19*c*), the qualified statements of Spearman in the 1912 paper with Hart, and the statements of the author ('14, p. 370 f.) than with a rigid, unqualified form of Spearman's doctrine. They are indeed adverse to the theory that the cognitive performances of an individual depend upon one general factor found in all, plus a specific factor not entering appreciably into any two, so long as these are moderately unlike. We cannot describe an ability by stating the proportion of it which is constituted by the general factor, and describing the specific factor which constitutes the balance. Checking pairs of numbers as like or unlike is not $XG + YN$, where G means general intelligence and N something found only in checking pairs of numbers or other abilities very closely like it. We may indeed find factors common to all cognitive performances but not in parallel amounts, factors common to many, factors common to few, factors specific to one.

We must, it appears, turn back with open mind to the details of intercorrelations and experimental analyses to work out the organization of intellect. Especially needed seem studies of the 'partial' inter-correlations with one after another of the factors equalized. For example, what are the variations and interrelations in various cognitive performances within a group all of identical status in understanding the vernacular language? The correlations of the columns also need not only to be tabulated to see their distribution, but also to be inspected in detail to see concretely and in particular what abilities *a*, *b*, *c*, etc., behave like others in their correlations with still others α, β, γ, etc.

For surety and convenience in this last enterprise we need, of course, original measures of high reliability, with large numbers of individuals, each measured in many traits, such as require heroic industry to obtain. The principle may, however, be briefly illustrated here from the Army data already used. For example, consider this question, "Which tests in Alpha behave most like which tests in Beta in respect to their intercorrelations?"[1] Of the fifty-six likenesses, the four most like are, in order:

Number completion with Symbol digit substitution,
Arithmetical problems with Symbol digit substitution,
Arithmetical problems with Number comparison,
Number completion with Number comparison

(corrected correlations of the columns, 641, .575, .532, .504). The four least like are, in order of unlikeness:

Opposites with Geometrical construction,
Common-sense questions with Geometrical construction,
Information questions with Geometrical construction, and
Arithmetical problems with Geometrical construction

(corrected correlations of the columns, − .648, − .647, − .642 and − .557).

If we now ask which tests the aberrant geometrical construction is like in its inter-correlations, we find .984 as the column correlation for it with the maze test, and .885 as the column correlation for it with the cube construction test. The next most like is only .456, the Symbol digit substitution test.

These cases are, as said, illustrative rather than evidential, but they obviously suggest that a 'numbers as content' factor and a 'spatial relations as content' factor act in a fashion midway between nearly complete generality and nearly absolute specificness. I believe that suggestions of factors referring to the 'form' of cognitive performances

[1] The number of individuals is here over 800, and the number of tests with which intercorrelations are computed is 15; the unreliability of the original measures is unknown, so that the examples should be taken as illustrative rather than demonstrative comparisons.

such as 'to keep in mind for a long time' or 'to utilize a large amount of content together for one purpose,' or 'to break up a gross total content into elements' will appear in a similar way in the correlations, partial correlations, and correlations of the correlations of cognitive performances.

All the above, of course, concerns individuals as we find them, products of nature and nurture. Spearman's doctrine might fit the *original* nature of intellect better. Certain factors, like ability to understand oral language, ability to read, ability to perceive objects in three dimensions, which occur to anybody as neither entering into all the cognitive performances of a person nor entering into only a few very closely similar performances, might in original nature be absorbed into one unitary ability to learn. Everybody will agree that many of the complexities of individual differences are superadded by likenesses and differences in training. I fear, however, that even if we did dissect out all the consequences of nurture, leaving only a skeleton of inborn capacities, the organization of these would still be much more complex than that required by Spearman's theory.

BIBLIOGRAPHY

HART, B. AND SPEARMAN, C. '12. General Ability, Its Existence and Nature. *Brit. J. of Psychol.*, **5**, 51–84.

MCCALL, W. A. '16. Correlation of Some Psychological and Educational Measurements. *Teachers College Contributions to Education*, No. 79.

RUGER, H. A. '10. The Psychology of Efficiency. *Arch. of Psychol.*, No. 15.

SPEARMAN, C. '04. General Intelligence: Objectively Determined and Measured. *Amer. J. of Psychol.*, **15**, 201–292.

SPEARMAN, C. '14. The Theory of Two Factors. PSYCHOL. REV., **21**, 101–115.

SPEARMAN, C. '20. Manifold Sub-Theories of "The Two Factors." PSYCHOL. REV., **27**, 159–172.

THOMSON, G. H. '16. A Hierarchy without a General Factor. *Brit. J. of Psychol.*, **8**, 271–281.

THOMSON, G. H. '19*a*. The Proof or Disproof of the Existence of General Ability. *Brit. J. of Psychol.*, **9**, 323–336.

THOMSON, G. H. '19*b*. The Hierarchy of Abilities. *Brit. J. of Psychol.*, **9**, 337–344.

THOMSON, G. H. '19*c*. On the Degree of Perfection of Hierarchical Order among Correlation Coefficients. Biometrika, **12**, 355–366.

THOMSON, G. H. '20. General versus Group Factors in Mental Activities. PSYCHOL. REV., **27**, 173–190.

THORNDIKE, E. L. '14. Educational Psychology, vol. 3.